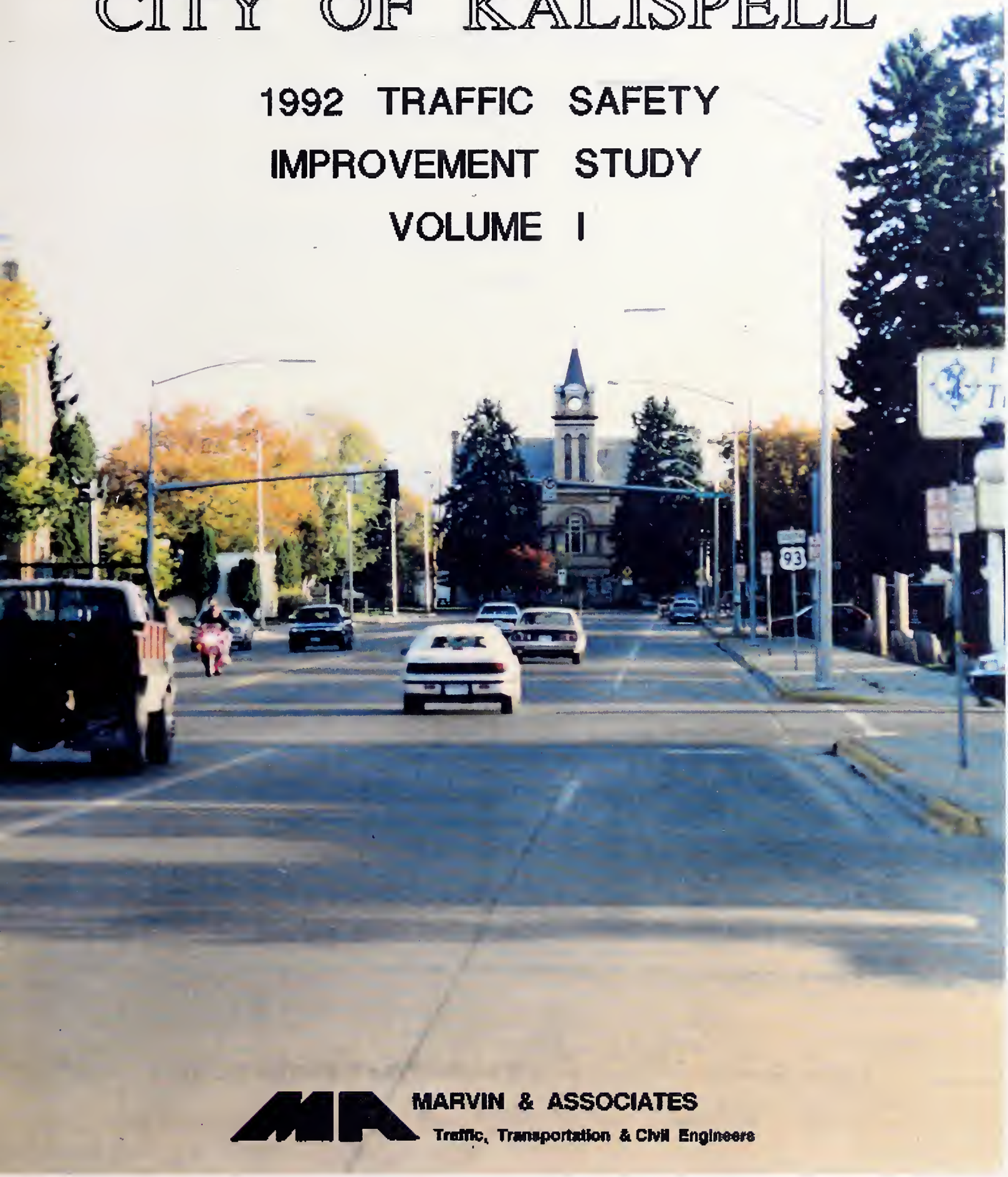
S Marvin &
625.7042Associates
K2tsis Traffic safety
1992 improvement study
V.1

CITY OF KALISPELL

1992 TRAFFIC SAFETY IMPROVEMENT STUDY VOLUME I



MARVIN & ASSOCIATES
Traffic, Transportation & Civil Engineers

MONTANA STATE LIBRARY
S 625.7042 K2tsis 1992 c.1 v.1
Traffic safety improvement study /
3 0864 00082725 6

TRAFFIC SAFETY

IMPROVEMENT STUDY

STATE DOCUMENTS COLLECTION

JUN 1 1993

MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620

PREPARED FOR

CITY OF KALISPELL

PREPARED BY

MARVIN & ASSOCIATES

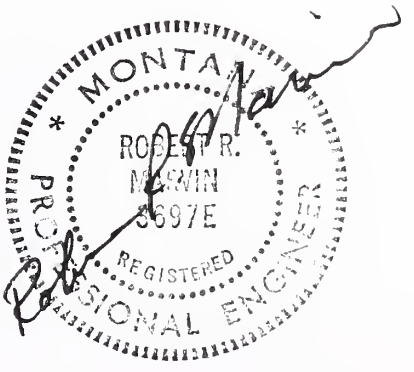
1127 ALDERSON AVE. 3204

BILLINGS, MT 59102

and

TDH ENGINEERING

Kalispell, MT



December 1992

PLEASE RETURN

TABLE OF CONTENTS

	PAGE
INTRODUCTION	
Study Purpose	1
Report Organization	3
SITE CHARACTERISTICS	
Site Locations	5
System Characteristics	
Traffic Volumes	7
Street Characteristics	11
Parking	12
Drivers & Vehicles	13
Traffic Control Devices	13
Traffic Accidents	15
Future System	16
STUDY METHODOLOGY	17
HAZARD INDEX ANALYSIS RESULTS	20
HAZARD RANKING	32

Digitized by the Internet Archive
in 2015

https://archive.org/details/trafficsafetyim1992marv_7

Table of Contents, cont.

EXPLANATION OF IMPROVEMENTS 34

BENEFIT/COST RATIOS

Costs 38

Benefits 39

B/C Ratio 40

PRIORITY INDEX 42

IMPLEMENTATION 45

STREET CORRIDORS 47

PROGRAM CONTINUATION 50

REPORT FIGURES 52

SITE ANALYSIS (See Site Sections 1 Thru 25)

LIST OF FIGURES

		Page
Figure 1.	Site Location Map	6
Figure 2.	Historical Factors	7
Figure 3.	Monthly Traffic Variations	8
Figure 4.	Daily Traffic Variations	9
Figure 5.	Hourly Traffic Variations	10

HAZARD INDICATOR VALUE CHARTS **52**

Figure 6.	Number of Accidents Indicator
Figure 7.	Accident Rate Indicator
Figure 8.	Severity Indicator
Figure 9.	V/C Ratio Indicator
Figure 10.	Sight Distance Indicator
Figure 11.	Driver Expectancy Indicator
Figure 12.	Information Deficiency Indicator
Figure 13.	Benefit/Cost Ratio Indicator

LIST OF TABLES

	PAGE
Table 1. List of Study Sites	5
Table 2. Preliminary Site Selection Matrix	18
Table 3. Site Ranking by Number of Accidents	21
Table 4. Site Ranking by Accident Rate	23
Table 5. Site Ranking by Accident Severity	24
Table 6. Site Ranking by V/C Ratio	26
Table 7. Site Ranking by Sight Distance	28
Table 8. Site Ranking by Driver Expectancy	30
Table 9. Site Ranking by Information Deficiency	31
Table 10. Site Ranking by Hazard Index	33
Table 11. Site Ranking by B/C Ratio	41
Table 12. Site Ranking by Priority Index	44
Table 13. Project Implementation Groupings	46

INTRODUCTION

STUDY PURPOSE

The City of Kalispell, in an effort to reduce or otherwise alleviate problems at accident cluster sites on the City street system, retained the Consulting Engineering Firm of Marvin & Associates to perform a traffic engineering study. The purpose of this study was to identify accident cluster locations, collect and analyze pertinent data, make short and long term safety improvement recommendations and establish a priority list of improvement projects.

Other studies using similar methods have been completed for Montana counties with the technical and financial assistance of the Montana Department of Justice, Highway Traffic Safety Division. The intent of the Highway Traffic Safety Division in sponsoring studies on county roads was to reduce accidents on county road systems and to establish an awareness of accident reduction measures so that a continuation of the program could be established within each county. In 1991, Highway Traffic safety shifted its emphasis to city street systems. The first two studies, completed in 1991, validated the analysis methods as applied to city street systems and this study represents a continuation of these efforts.

Since most major cities in Montana have traffic engineers or technicians on staff and are benefited by other safety programs, the intent of the safety improvement study is somewhat different than those completed in Montana counties. Much of major urban area street systems are designated as Federal Aid Routes. The classifications range from Primary Highways to Federal Aid Urban streets. These streets are usually urban arterials and collectors which have high traffic volumes. Monitoring accident data and traffic volumes; developing improvement projects; planning new facilities; and maintaining the system, is usually handled by the City and State. Programs such as the TSM Element of the Transportation Planning Process and the Montana Department of Transportation's Safety Program adequately cover most of the safety problems within Montana's major cities. Day-to-day operations

on the street system cover accident problem areas as they are brought to the attention of the city staff through citizen complaints or police requested investigations. Thus, this study is focused on those locations which may not be included in any of the formal State or City programs. Most of the accidents sites are on streets which do not fall under federal aid classifications and are commonly known as "Off-system" streets. Some of the study sites may be at locations that the City has implemented controls in the past, but have defied efforts at improving safety. The majority of sites are usually low volume streets which have had minor, but consistent accident problems. Because of a low number of accidents per year, these locations are not readily recognized as accident cluster sites. When subjected to intense analysis, as contained in this study's methods, large benefits from simple inexpensive improvements can be recognized. Thus, the purpose of this study is to identify accident cluster sites on city streets; recommend improvements; prioritize site improvements; and introduce cities to the methods used in this type of analysis.

The methodology used in this study, which primarily serves as the basis for the analysis, can be found in report *No. FHWA-RD-77-83 "Identification of Hazardous Locations"*. Refinements to the FHWA report made by *DCA Project No. 79-04-01-01* and subsequent county studies throughout the state, are also incorporated within this report. The methodology used to establish priority rankings is explained in the Benefit/Cost Ratio section of this report and is tailored specifically to the City of Kalispell's unique requirements.

Traffic safety improvements contained within this report will qualify for the Montana Department of Transportation, Off-system Safety Funds. Because of this, priorities and funding obligations are specifically tailored to MDoT requirements. Upon approval by the City of Kalispell, this report should be submitted to MDoT as justification for Off-system Safety fund allotments.

REPORT ORGANIZATION

The initial section of this report contains narratives describing the accident cluster site locations, characteristics of the city street system, study methodology, results of the hazard index analysis for all of the sites, explanation of the improvements recommended, priority index calculations, an implementation schedule and recommendations for continuation of the program in future years. Special attention should be given to the Site Characteristics and Explanation of Improvements sections, since specific traffic safety information for the Kalispell street system is presented in these sections.

Site specific data can be found within the individual site sections following the main body of this report. Site specific sections contain brief narratives regarding site conditions, observed problems, and recommendations. Also included is an accident summary page, 35mm pictures of the site, and supporting information as required.

A great deal of computer generated data was printed and reduced for inclusion on the existing condition and short term improvement sketches. The availability of pertinent data on the same page as the sketches hopefully aids in comprehension of the problem identification and improvement benefits. The short term plan sketches can also be used by the MDoT to verify the traffic control device items eligible for funding through their program. These sketches, being too voluminous for inclusion within this report, are bound separately as a plan package and titled "Volume II". Any references to existing conditions or short term improvements within this report can be found in the that document. The 11"x17" plan sketch book can also be used by the City Street Department or be incorporated into a set of contract plans in the future, for actual implementation of most improvements.

The site specific sections of this report are numbered according to their priority ranking as indicated in the site location section of this report. Twenty five (25) sites are included in this project, as per the contract budget. Some of the sites

were located in close proximity along single streets. In addition, other sites identified during the screening process indicated that some streets have accident problems at almost every intersection and significant numbers between intersections. At these locations a general evaluation of the corridor was completed. In this case, several corridors have been identified which may or may not be specifically addressed within the transportation plan, currently being completed. The following corridor areas are further discussed within this report:

Meridian Road
Montana Street
First Avenue West
Downtown Streets
High School Area Streets

SITE CHARACTERISTICS

SITE LOCATIONS

The map on the following page (Figure 1.) shows the twenty five accident sites numbered according to their respective priority numbers. Table 1., below, is a listing of site numbers corresponding to the site locations:

TABLE 1. LIST OF STUDY SITES

PRIORITY SITE NO.	INTERSECTION STREETS	
1	SIXTH AVE. W.	THIRD ST.
2	THIRD AVE. W.	THIRD ST.
3	THIRD AVE. W.	EIGHTH ST.
4	SECOND AVE. W.	EIGHTH ST.
5	FIRST AVE. W.	ELEVENTH ST.
6	FIFTH AVE. E.	THIRD ST.
7	MERIDIAN ROAD	BUTTREY'S ACCESS
8	FIRST AVE. W.	MONTANA ST.
9	SECOND AVE. W.	MONTANA ST.
10	SECOND AVE. W.	FIFTH ST.
11	SECOND AVE. W.	FIRST ST.
12	SIXTH AVE. W.	FIFTH ST.
13	THIRD AVE. W.	FIFTH ST.
14	FOURTH AVE. W.	FIRST ST.
15	SECOND AVE. W.	SECOND ST.
16	FIRST AVE. W.	TWELFTH ST.
17	SECOND AVE. W.	THIRD ST.
18	FIFTH AVE. W.	MONTANA ST.
19	FOURTH AVE. W.	CENTER ST.
20	WOODLAND DRIVE	SECOND ST.
21	FIRST AVE. E.	MONTANA ST.
22	MERIDIAN ROAD	TWO MILE ROAD
23	FIRST AVE. W.	WASHINGTON ST.
24	SIXTH AVE. W.	SEVENTH ST.
25	FIRST AVE. W.	CENTER ST.

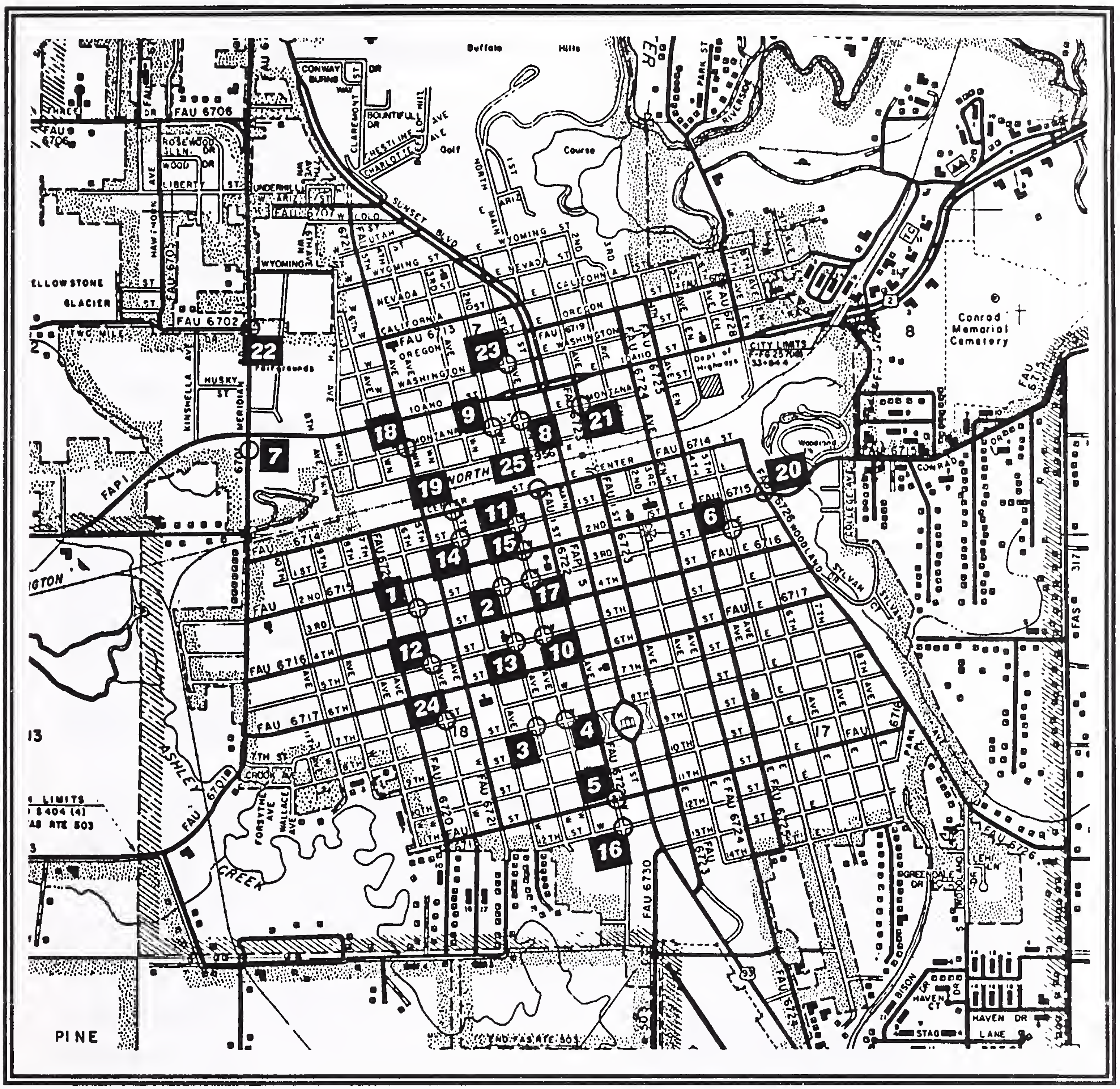


FIGURE 1. SITE LCOCATION MAP - KALISPELL

SYSTEM CHARACTERISTICS

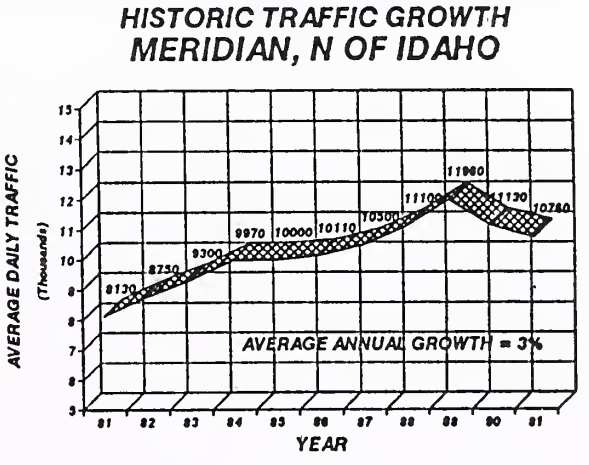
Traffic Volumes - All of the accident sites are located in a completely urban environment on mostly low volume streets. The highest traffic volume at any site is approximately 14,400 vehicles per day entering an intersection, while the lowest volume is approximately 600 vehicles per day entering. The average of all sites is approximately 5,100 vehicles per day entering. Average Daily Traffic (ADT) on all of the streets involved is approximately 2,600 and ranges between 12,600 and 200. The City of Kalispell has numerous Federal Aid Urban Routes which the Montana Department of Transportation counts on a regular basis. Most of the count sites were on or near all of the study sites.

The Montana Department of Transportation has a permanent count station in Kalispell, located on Idaho Street (US 2). Information taken from this count station was used to develop factors in estimating ADT's at the study sites.

Historical Factors

Data provided by the Montana Department of Transportation indicated that traffic volumes on city streets have remained fairly constant over the past four years. There were streets that had dramatic increases and other streets that had significant decreases. However, within the past year, traffic volumes have begun to increase at a number of locations. Data from those stations provides general, long range trends in traffic growth.

Figure 2. illustrates traffic growth on Meridian Road, which is representative of most city streets within the past decade. Generally, traffic is growing at an annual rate of approximately 3.0 percent. Recent counts at this site indicate that 1992 volumes are 500 vehicles higher than the previous 1989 peak.

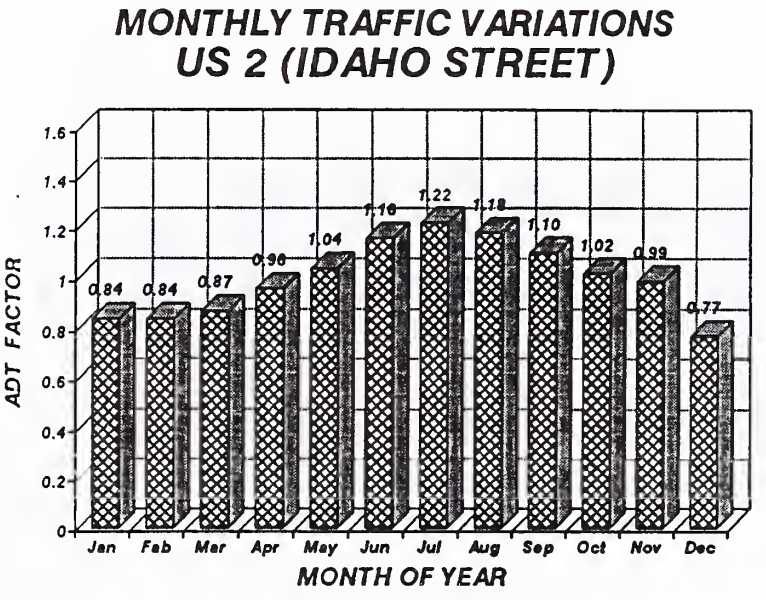


Monthly Variations

A key factor in estimating average daily traffic is the month of the year. Traffic tends to vary significantly depending on the weather, seasonal economy, school sessions and various other reasons. Monthly variations provide an accurate reflection of seasonal conditions.

Figure 3. illustrates monthly traffic variations for Idaho Street at the permanent count station. This data indicates that their are normal variations between months of the year.

July is the highest volume month, with approximately 122% of average monthly traffic. December is the lowest traffic month with ADT's being about 77% of the average month.

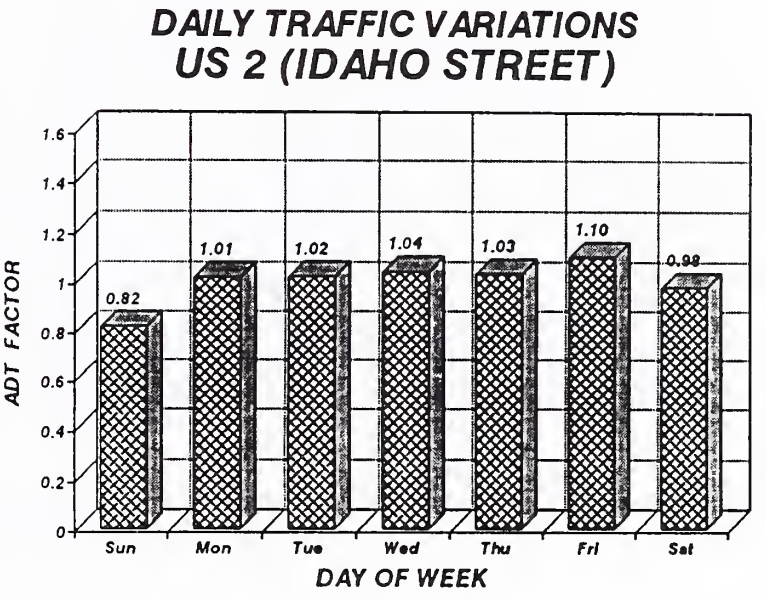


The influence of tourism in Kalispell and the area in clearly seen within this graph. The highest three months of the year are the summer vacation months. December traffic volumes are less than what would be expected.

Daily Variations

Traffic volumes vary significantly according to the day of the week and play an important role in estimating average daily traffic. Factors derived from extended traffic counts are not usually as reliable as monthly or seasonal factors due to the smaller time frame. Special holidays and events tend to skew daily variations. As an example, Monday holidays tend to have lower traffic than normal while the following Tuesday has higher than normal traffic.

Figure 4., right illustrates daily traffic variations in Kalispell. This data was extracted from the permanent count station on Idaho Street.



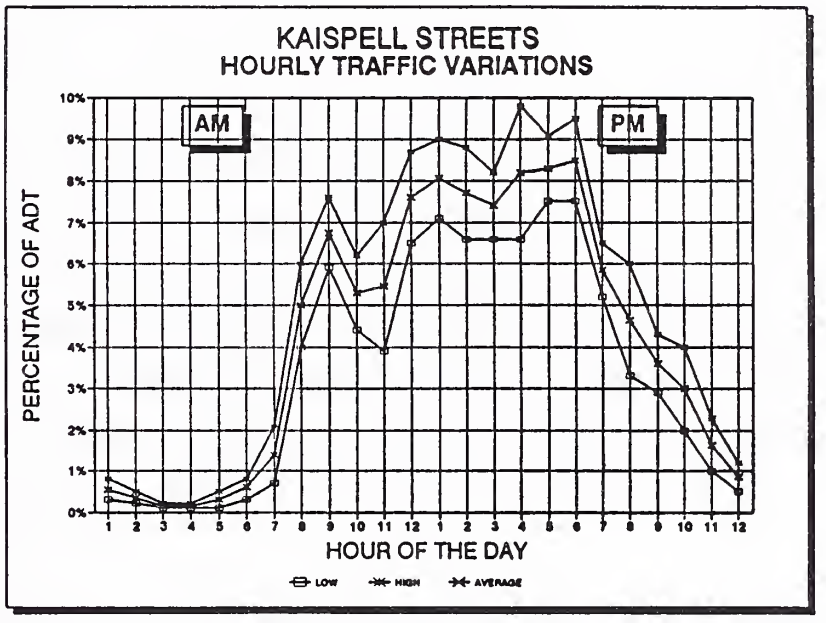
The highest traffic day of the week is Friday, with 110% of average daily traffic. The lowest traffic day is Sunday, with only 82% of ADT. The remaining weekdays are fairly consistent at 101 to 103% of ADT.

These daily variations compare closely with most streets within the urban areas of Montana and the Idaho Street counts appear to be fairly representative of most Kalispell streets.

Hourly Variations

Variations in traffic volumes by time of the day is highly predictable since there is usually no significant differences from one weekday to the next, at any one location. However, differences between various types of streets and locations can be vastly dissimilar. Twenty four hour machine recording counts on the same or similar streets are necessary to accurately estimate ADT's from shorter period counts.

Figure 5., right, presents hourly traffic variations on all available MDT count stations on Kalispell Streets. Third South. Estimates of ADT from hourly counts, within this study, were based on individual site variations.



This graph shows the high, low and average percentile range of all count stations. Most of the count stations have similar shaped curves.

There appears to be two characteristic types of curves. Streets outside of the downtown area have distinct morning noon and evening peaks, similar to the above graph. Downtown streets tend to have less distinct peaking characteristics. Downtown street curves rise drastically in the morning, level off between 9 AM and 5 PM and drop significantly in the evening.

Street Characteristics - The Kalispell city street system is laid out on a grid system with only slight variations in orientation. Most of the streets which vary from the north-south and east-west grid, lie on the fringe areas of the city. Most of the study accident sites are within the standard grid pattern.

There are two major highways which traverse Kalispell; US 93 and US 2. US 93 is a north south arterial incorporated as part of the urban street system and is known by two different names ie. Main Street and Sunset Boulevard. US 2 is an east-west arterial known as Idaho Street, within the city limits. These arterials carry cross town traffic as well as all interstate, intrastate and international traffic, including commercial trucking. Traffic operations on these streets can best be described as mixed congestion. Poor operating conditions on these critical arterials spill off onto other system streets well beyond normal corridor boundaries. It is estimated that a large percentage of traffic on local and collectors streets is routed by avoidance of the two highways rather than by local street facilities' level-of-service. Streets parallel to the arterials do not have sufficient continuity nor capacity to effectively handle spill-over traffic, which accounts for high traffic volumes on what would be normally be considered local streets. Because of these conditions, Kalispell has an inordinate number of streets designated as Federal Aid Urban Streets carrying arterial and collector type traffic.

Streets outside of the older grid system in Kalispell tend to be more rural in nature and intersections are more widely spaced. Because of less dense land development and discontinuity of the street system in this area, traffic volumes on streets other than highways and arterials are usually low. The number of accidents on the street system in this area is also lower due to less traffic, increased sight distance and adequate intersection spacing.

Another distinguishing feature of the Kalispell street system is narrow right-of-way and street widths. Most of the older sections of town have streets with rights-of-way at 60 feet or less. Local street widths average approximately 34 feet and there are many streets that are 31 feet or less in width. Considering the heavy on-street parking demand within some areas of Kalispell, streets appear to be con-

fining and difficult to drive, comfortably. In addition, building setbacks on most lots are not sufficient to provide minimum sight distance requirements at uncontrolled intersections.

Physical characteristics of the streets are typical of older design standards with a few areas having more modern street and access control features. The majority of street surfaces could be classed in a poor to good category. A significant number of street surfaces in the residential areas are in poor condition with many potholes. Interestingly, in most cases, east-west streets are in much better condition than north-south streets. Condition of street surfaces appear to have only a minor effect on accident experiences at most of the sites.

Another common observation at local intersections was the roadside environment relating to trees, hedges and fences within the intersection sight triangle. There were many areas where vegetation was over-grown to the point of creating obvious sight distance problems. Wherever stop signs were present, there were attempts made to keep tree branches trimmed near the stop sign, but not on trees in advance of those signs. At other locations, tree trunks in the boulevard areas are so large that they sometimes create an intermittent sight restriction which may be related to some of the angle accidents. These type of blind spots can sometimes be more hazardous than a large imposing sight restriction because motorists are not consciously aware of the brief loss of sight.

Parking - A common problem observed at some of the study sites, involved lack of parking controls near intersections. While many of the sites have signs and yellow curb marks, most of the local residential streets do not. This is entirely understandable, since it is very costly to mark every intersection when the majority of the time there are no apparent problems. Even when an accident problem appears, it is very difficult to attribute it to a mobile sight restriction. Only when changes in traffic volumes or parking habits occur do accident problems start to appear.

Enforcement of parking restrictions, when marked, is also critical to safe traffic operations. If periodic monitoring and ticketing of improperly parked vehicles is not done, drivers loose respect for parking control devices.

Parking demand obviously exceeds supply within some portions of Kalispell, particularly in the downtown area and in the area around the high school. Since parking operations typically conflict with traffic operations, higher on-street parking demand creates a lower level of safety and efficiency on the street system.

Angle parking, which is the natural enemy of safe traffic flow, was not observed at many locations in Kalispell. This is probably because street widths are too narrow to even attempt that type of parking scheme.

Drivers & Vehicles - Kalispell drivers are on a par with drivers in other Montana cities and in some circumstances may be even more aggressive than those in some larger Montana cities. The fact that Kalispell is a smaller city with a less pressured life style, is apparently compensated for by the congestion of its street system. Delays at major intersections contribute to decreased start-up times and increased acceleration rates after a period of conditioning. The only problem with driver aggressiveness in Kalispell is that this characteristic is not homogeneous. A significant percentage of drivers are rural residents and tourists who do not use the city streets on a daily basis. Therefore, driver behavior varies widely. With this heterogeneous mixture of behavior, driver expectancy is continually violated and accidents become more probable.

Traffic Control Devices - No traffic control devices other than street name signs were present at a majority of the study sites. At those sites which had some degree of traffic control devices, the applications range from street name signs to regulatory signs and in one case a traffic signal. Most of the signs and markings were applied correctly according to the Manual on Uniform Traffic Control Devices (MUTCD). One significant exception to use of standard signs was at signalized intersections. Some very unconventional signs were used to indicate multiple lane control configurations on the signal mast arms. Use of these signs must be unique to the area, since none of them have been noted in other Montana cities.

Street signs appear to be in good condition at most of the sites. All study locations had street name signs, but they were not mounted in consistent locations and

most of them were non-reflective white with black letters. Lack of street name sign visibility can become a major safety problem for motorists not familiar with Kalispell. In this situation, a large portion of the drivers cognitive powers are directed toward navigation. When there is little positive guidance provided, critical driving mistakes can be committed because little conscious ability remains for the other varied driving tasks.

Some damaged and faded signs were noted throughout the city. While the percentage of total signs falling into that categoryis not very large, it is important to replace signs when they become ineffective. The City of Kalispell, if it has not already begun, should begin developing a complete sign inventory and management system. Through this system, signs are replaced on a priority basis as budget allows. It is recommended that the City develop a program which allows all signs, regardless of priority, to be replaced after a maximum period of time in the sign's life.

There are numerous traffic signal installations within the City of Kalispell. All of those signals are on the Federal Aid System. Several problems could be cited with the signal installations. The most significant problems appear to be inadequate street geometry, lane control, phasing and coordination. Lane control, traffic volumes and signal phasing schemes at many of the major intersections require very long cycle lengths and excessive delay. Signal hardware is a mixture of old and new. There are some very interesting combinations of signal head sizes and pedestrian signal indications that should be replaced to provide increased visibility and consistency.

There are also many intersections within Kalispell which obviously warrant signals. At some locations, particularly on streets east of Main (US 93), an attempt to increase capacity at intersections was made by converting the streets to multiple lanes. The result is two-way and four-way stops with exclusive turn lanes and multiple thru lanes. This configuration creates driver miscues and sight distance restrictions caused by vehicles moving side-by-side, which results in many conflicts. Hopefully, these changes were not created to increase traffic signal warrant limits.

Traffic Accidents

Traffic accident characteristics for all of the Kalispell study sites are summarized below:

Category	Total	Average Per Site
Total Number of Sites	*25*	*NA*
Total Number of Accidents	*241*	*9.60*
Study Period in Years	*4.0*	*4.0*
Traffic Volumes Entering	*NA*	*4871*
Accident Rate /MVE	*NA*	*2.69*
No. of Injuries	*69*	*2.76*
No. of Fatalities	*0*	*0*
Severity in 1000's $	*1,166*	*4.84*
No. Angle Accidents	*183*	*7.83*
No. Rear End Accidents	*24*	*0.96*
No. Sideswipe Accidents	*14*	*0.56*
No. Pedestrian Accidents	*3*	*0.12*
No. Single Vehicle Accidents	*3*	*0.12*
No. Left turn Accidents	*7*	*0.28*
No. Parked Car Accidents	*6*	*0.24*
No. of Other Type Accidents	*1*	*0.04*

Of all the years in this period, 1991 had the least number of accidents (50), while 1988 & 89 had the most with 67 each. The predominant trend would appear to be decreasing accidents at the study sites. However, two of the study sites had improvements installed in 1990-91 which virtually eliminated accidents. These improvements were more than enough to account for the fewer number of accidents in 1991.

Angle accidents were the most common accident type, which accounts for the relatively high number of injuries. Most of the accidents occurred in clear weather on dry roads. However, a high percentage (30%) of the accidents occurred on snowy or icy streets. Considering the low percentage of time that the streets are in this

condition and lower traffic volumes during these conditions, it is apparent that increased winter time maintenance would be warranted.

Night time accidents were not as common as daytime accidents. No fatal accidents occurred within the study sites. The average accident rate per site of 2.69/mve is higher than the typical intersection, as would be expected. There were accident rates as high as 8 accidents/mve among the study sites, which is nearly 8 times the typical urban intersection rate and among the highest calculated within Montana's urban areas.

Future System Characteristics - Kalispell has been involved in the process of completing an approved transportation plan and truck by-pass study which will outline certain transportation improvement projects to be constructed within the next twenty years. Some of the study sites may be affected by this plan in the future. The transportation plan consultant, Joe Hart of CRSS, has been coordinating the plan development with this study and the final transportation plan submittal will undoubtedly consider the recommendations made within this report. It is also assumed that any proposed improvement within this report will be coordinated with future project recommendations. Some of the study sites provide short term solutions to problems which would be better served by more capital intensive long range projects or by projects having more far reaching effects than those served by short term improvements. The transpotation plan should consider long term improvements at these locations.

STUDY METHODOLOGY

The study was segregated into four distinct phases which best achieved the purpose and scope of the traffic study. These phases are outlined as follows:

Phase 1, Site Selection - involved copying all of the accident reports on Kalispell city streets for the years 1988 thru 1991 from Department of Justice files in Helena, Montana. The state reports were sorted and arranged by Avenues and Streets and then cross referenced by intersection. On-system sites for the two major highways, US 93 and US 2, were separated and forwarded to CRSS for use in the transportation planning process. The remaining reports were then screened for locations having 5 or more accidents during the reporting period. Cross referenced accidents were confirmed and then entered into a computer program to calculate preliminary hazard index values.

Number of accidents, accident rates and severity indexes were calculated for fifty-four cluster sites. Table 2. is a summary of the screening program. The cluster sites were ranked according to the composite value of three indexes. A recommended list of sites was given to Donald Hossack, Assistant Chief of Police, City of Kalispell, for his review and approval. The list was modified due to current and local knowledge of the street system and by the Cities' desire to analyze specific problem areas. After undesirable sites had been eliminated, the final list of sites was approved by Mr. Hossack.

TABLE 2. CITY OF KALISPELL - ACCIDENT SITE SCREENING LIST
RANKING BY COMPOSITE ACCIDENT FACTOR

SITE RANK NO.	INTERSECTION WITH AVENUE or STREET	STREET OR AVENUE	ACCIDENTS / YEAR 88	89	90	91	TOTAL NO. ACC.	NO. ACC. INDEX	APPROX. VOLUME	ACC. RATE	ACC. RATE INDEX	SVRTY INDEX	COMPOSI SCREEN INDEX
1	FIFTH AVE W	FIFTH	3	1	3	0	7	56	2000	2.50	50	100	66.5
2	FIRST AVE W	ELEVENTH	7	9	3	5	24	90	5000	3.43	63	50	66.3
3	MERIDIAN	THREE MILE RD	4	7	3	7	21	66	5000	3.00	57	48	62.3
4	MONTANA	SECOND W	5	6	8	0	21	66	6000	2.50	50	49	59.5
5	SIXTH AVE W	THIRD	4	1	2	3	10	67	3500	2.04	42	67	57.2
6	MONTANA	FIFTH W	2	2	6	3	13	74	4000	2.32	47	62	56.0
7	SUNSET	WYOMING	6	9	7	5	27	92	14000	1.38	31	53	55.4
8	FIRST AVE W	SECOND	2	2	6	7	19	64	10000	1.36	30	55	53.5
9	WOODLAND	SECOND E	5	5	3	3	16	79	6000	1.91	40	46	53.1
10	FIRST AVE W	THIRD	1	3	6	10	20	65	6000	1.79	36	42	52.4
11	CENTER	FOURTH W	3	3	3	2	11	69	4000	1.97	41	61	52.1
12	SECOND AVE W	EIGHT	2	4	4	3	13	74	5000	1.86	38	49	51.9
13	THIRD AVE W	THIRD	3	7	0	3	13	74	6000	1.55	34	52	51.1
14	FIRST AVE E	SECOND	3	9	6	3	21	66	13000	1.15	26	49	50.6
15	FIFTH AVE W	FOURTH	4	1	4	5	14	76	6600	1.47	32	50	50.4
16	FIRST AVE E	FOURTH	2	4	7	2	15	76	7500	1.43	32	49	50.4
17	WASHINGTON	SECOND W	0	0	3	4	7	56	2500	2.00	42	54	50.2
18	FIRST AVE W	FIRST	5	4	3	3	15	76	7900	1.36	30	49	49.9
19	FIRST AVE E	THIRD	4	1	7	4	16	79	6000	1.43	32	46	49.6
20	MERIDIAN	TWO MILE RD	3	3	2	4	12	72	5400	1.69	34	47	49.0
21	THIRD AVE W	FIRST	0	2	2	2	6	54	3500	1.23	26	69	48.6
22	CENTER	FIFTH W	4	6	3	3	16	79	9000	1.27	29	44	48.0
23	THIRD AVE W	FIFTH	1	3	0	3	7	58	3000	1.67	36	53	47.6
24	FOURTH AVE E	SECOND	3	6	2	1	14	76	7000	1.43	32	41	47.2
25	FIRST AVE W	FOURTH	1	4	7	2	14	76	9000	1.11	26	48	46.9
26	SEVENTH AVE W	SIXTH	4	1	0	2	7	56	2400	2.08	43	41	46.6
27	FIRST AVE W	SIXTH	4	3	1	4	12	72	6600	1.26	26	46	46.4
28	SIXTH AVE W	FIFTH	2	1	1	2	6	64	2000	2.14	44	43	46.4
30	SEVENTH AVE W	FOURTH	2	5	0	0	7	58	3500	1.43	32	54	46.3
31	MONTANA	FIRST E	3	3	1	0	9	64	3000	2.14	44	33	46.0
32	THIRD AVE W	EIGHT	1	1	4	1	7	58	3000	1.67	36	48	45.9
33	MONTANA	FIRST W	2	4	3	2	11	69	5000	1.57	34	39	45.5
34	FOURTH AVE W	FIRST	6	1	0	4	11	69	6000	1.31	28	43	45.2
35	SUNSET	UTAH	4	3	3	2	12	72	14000	0.61	15	56	45.2
36	FIRST AVE W	TWELFTH	1	2	3	0	6	54	4000	1.07	25	61	44.9
37	FIFTH AVE E	THIRD	3	3	1	0	7	58	4000	1.25	29	53	44.6
38	SECOND AVE W	SECOND	1	4	2	2	9	64	8000	0.80	19	57	44.4
39	SECOND AVE W	FIRST	3	4	1	3	11	69	4800	1.64	35	33	44.1
40	FIRST AVE W	TENTH	2	4	1	2	9	64	5500	1.17	27	46	43.6
41	FIRST AVE E	ELEVENTH	3	1	3	1	8	61	4500	1.27	29	46	43.6
42	WASHINGTON	FIRST W	1	4	1	0	6	54	2500	1.72	37	43	43.6
43	MERIDIAN	BUTTREYS	2	2	2	0	6	54	8000	0.54	14	67	42.9
44	FIFTH AVE W	THIRD	2	6	1	3	12	72	6000	1.07	25	54	42.0
45	FIRST AVE E	THIRTEENTH	3	4	1	2	10	67	5000	1.43	32	33	41.9
46	FIRST AVE W	FIFTH	0	0	3	4	7	56	3000	1.67	36	33	41.1
47	CENTER	FIRST W	1	4	1	3	9	64	8000	0.80	19	45	40.4
48	SECOND AVE W	THIRD	1	2	4	2	9	64	6500	0.99	23	40	40.1
50	SEVENTH AVE W	SECOND	2	2	1	1	6	54	3500	1.23	26	43	40.1
51	SECOND AVE W	FIFTH	1	3	2	2	8	61	5500	1.04	24	41	39.9
52	FIFTH AVE W	SECOND	1	2	1	3	7	58	3500	1.43	32	33	39.4
53	FIFTH AVE W	FIRST	1	2	1	2	6	54	4500	0.95	22	43	36.0
54	SIXTH AVE W	SEVENTH	0	4	2	0	6	54	8500	1.23	28	33	36.9
		TOTALS =	133	163	146	134	596						
		AVE. YEAR =	2.6	3.5	2.6	2.6	11.5	66.2	5751.9	1.5	33.2	48.5	47.9

COMPOSITE INDEX WEIGHTING: Number Accidents = 26%, Accident Rate =39%, Severity = 33%

Denotes Sites Selected for Study

Phase 2, Data Collection - included preliminary organization of the project including scheduling, site location, form processing, field data collection and reduction of data. Accident data was obtained from reports provided by the Department of Justice. Traffic counts were taken at each location. The existing average daily traffic was determined by applying factors for hourly, daily and monthly variations. Other data collected in the field, included measurement of road widths and geometrics, and inventory of traffic control devices, turning movement counts and subjective observation of traffic operations. Thomas, Dean and Hoskins Engineering of Kalispell performed the field topo surveys and sign inventories. Final drafting of the base sheets was performed by Marvin & Associates.

Phase 3, Analysis of Data - included the determination of hazard indexes for each location by using the Federal Highway Administration Report *No. FHWA-RD-77-83 "Identification of Hazardous Locations"*. Computations involved with accidents, volumes, capacities, indicator values and other aspects of hazard indexes were performed on a microcomputer using original templates for Ouattro Pro Ver. 4.0, developed by Marvin & Associates. Regression equations were developed to mathematically simulate hazard index curves contained in the FHA report. From these computations a preliminary hazard ranking list was prepared.

Phase 4, Evaluation of Corrective Measures - included the determination of improvements that would reduce or eliminate certain types of accidents or accidents in general at the study locations. Preliminary designs of those improvements included signing, geometric changes, and some minor reconstruction. The improvements were recommended on a short term basis. In most cases, the nature of the sites were such that long term improvements would not provide additional benefits beyond those expected through implementation of short term improvements.

Cost effectiveness calculations of the improvements at each location were determined by preparing preliminary cost estimates and computing economic benefits to arrive at a benefit/cost ratio. The method used to determine benefit/cost ratios is identical to that used by the Montana Department of Transportation Project Planning Section. All values used in the formulation were supplied by Hank Butzlaff, supervisor of that section. The composite hazard index ranking and benefit/cost ratio, then determined the final priority listing.

HAZARD INDEX ANALYSIS RESULTS

Seven hazard indexes were used as the preliminary basis of ranking hazardous sites. The following are brief descriptions of each index including data format, data collection, indicator scaling and site ranking with respect to each index.

1. **Number of Accidents** - This indicator provides a historical background of accidents at the investigation site. In the case of Kalispell, a four year period was used, which included 1988 thru 1991. The accident reports were photo copied in Helena and provided to the consultant. The data represents all reports filed within the city limits of Kalispell.

Figure 6. is a curve extracted from the FHWA report which was used to determine the indicator value. The data base is number of accidents per year. This indicator, as with all of the seven indicators used in the report, is scaled between 0 and 100. An average of two accidents per year in a three year period indicates a hazardous location (indicator value of 33). An average of ten accidents per year is used to designate a very hazardous location (indicator value of 67). In the case of this study, the total number of accidents per site criteria was used to extract the index value rather than the annual rate. This higher value is therefore more consistent with the level of the other index values. Using an annual rate would have scaled down the importance of this indicator relative to other index values. Table 3. is the computer generated ranking of all sites based on this indicator. It can be seen that none of the sites exceeded the maximum value of 100 and the average value was in the same range as other hazard index values.

2. **Accident Rate Indicator** - This indicator somewhat compensates for any incomplete information provided by the number of accident indicator in that an exposure value is provided by the relationship between accidents and the total volume of vehicles using the facility. This indicator is expressed as the number of accidents per million entering vehicles. In the case of an intersection, "million entering vehicles" is the sum of the daily average approach volumes on all legs of the intersection, multiplied by the number of days in the analysis period.

TABLE 3. SITE RANKING BY NUMBER OF ACCIDENTS

RANK NO.	AVENUE	STREET	ACCIDENTS / YEAR 88	89	90	91	TOTAL NO. ACC.	NO. ACC. INDEX
1	FIRST AVE. W.	ELEVENTH ST.	8	4	3	5	20	85
2	SECOND AVE. W.	MONTANA ST.	6	6	7	0	19	84
3	WOODLAND DRIVE	SECOND ST.	5	4	3	3	15	78
4	FIFTH AVE. W.	MONTANA ST.	2	2	6	3	13	74
5	MERIDIAN ROAD	TWO MILE ROAD	3	3	2	4	12	72
6	SECOND AVE. W.	EIGHTH ST.	2	3	4	3	12	72
7	FIRST AVE. W.	MONTANA ST.	2	3	3	2	10	67
8	FOURTH AVE. W.	CENTER ST.	3	2	3	2	10	67
9	SECOND AVE. W.	SECOND ST.	2	3	2	3	10	67
10	THIRD AVE. W.	THIRD ST.	4	3	0	3	10	67
11	FIRST AVE. W.	CENTER ST.	2	3	1	3	9	64
12	MERIDIAN ROAD	BUTTREY'S ACCES	3	2	2	2	9	64
13	SECOND AVE. W.	FIRST ST.	2	3	1	3	9	64
14	SIXTH AVE. W.	THIRD ST.	3	1	2	3	9	64
15	FIFTH AVE. E.	THIRD ST.	3	4	1	0	8	61
16	FOURTH AVE. W.	FIRST ST.	6	1	0	1	8	61
17	SECOND AVE. W.	THIRD ST.	1	2	3	2	8	61
18	SECOND AVE. W.	FIFTH ST.	1	4	1	2	8	61
19	THIRD AVE. W.	FIFTH ST.	1	3	0	3	7	58
20	THIRD AVE. W.	EIGHTH ST.	1	1	4	1	7	58
21	FIRST AVE. E.	MONTANA ST.	3	2	1	0	6	54
22	FIRST AVE. W.	TWELFTH ST.	1	1	4	0	6	54
23	SIXTH AVE. W.	FIFTH ST.	2	1	1	2	6	54
24	FIRST AVE. W.	WASHINGTON ST.	1	3	1	0	5	50
25	SIXTH AVE. W.	SEVENTH ST.	0	3	2	0	5	50
		TOTALS =	67	67	57	50	241	
		AVERAGES =	2.7	2.7	2.3	2.0	9.6	64.4

The accident rate indicator is a very important part of the hazard index ranking method and data collection is possible when a continued program of traffic counting has been performed. Spot counts adjusted by yearly volume increases, seasonal variations, daily variations and hourly variations were necessary at most of the sites to develop an average daily traffic figure applied to the analysis period.

Figure 7 represents the graphic plot of accident rate versus indicator value. As before, the indicator value ranges between 0 and 100. Table 4 is the computer generated ranking of sites based on this indicator. It can be seen that the intersections included in this study produced a wide range of accident rates commensurate with large differences in traffic volumes. The average rate index was 47.

3. Accident Severity Indicator - Although there are many factors involved in the severity of accidents, statistical studies over a significant number of years have given fairly reliable dollar values in terms of economic loss for each type of accident. The accident severity indicator correlates a probable cause and effect relationship which aids in the determination of the level of accident reduction measures required. Severity values can also be used as a determinant of benefits resulting from various improvements. The data base for accident severity is average relative severity in thousands of dollars. Data collection necessary for the use of the severity index is made possible by the accident report form. Dollar values for severity were provided by Hank Butzlaff of the Montana Department of Transportation. They are: Fatal Accident = $500,000, Injury Accident = $11,000 and Property Damage Accident = $2,000. Recently, the method of calculating fatal and injury costs was changed by MDoT to include total number of persons injured or killed rather than just an injury or fatal accident as a single incident. In the case of this study, some single accidents produced multiple injuries which increased the relative severity of those sites significantly.

The FHWA report presents the relative severity index values for each type of accident. Once the type of accident has been established, Figure 8 enables the user to assess the indicator value. Figure 8 is a graphic plot of the average severity in thousands of dollars versus the indicator value which is based on a scale of 0 to 100. Table 5 is the computer generated ranking of sites based on this indicator.

TABLE 4. SITE RANKING BY ACCIDENT RATE

RANK NO.	STREET/AVE	STREET/AVE	NO. ACC. 4.00 YEARS	1991 ADT	ADT PERIOD AVE.	AC. RATE (MVE)	ACC RATE IND VALUE
1	THIRD AVE. W.	EIGHTH ST.	7	600	600	7.99	100
2	SIXTH AVE. W.	THIRD ST.	9	800	800	7.71	100
3	SECOND AVE. W.	EIGHTH ST.	12	1200	1200	6.85	99
4	SIXTH AVE. W.	FIFTH ST.	6	900	900	4.57	77
5	SECOND AVE. W.	MONTANA ST.	19	3050	2877	4.52	76
6	SECOND AVE. W.	FIFTH ST.	8	1250	1250	4.38	75
7	THIRD AVE. W.	THIRD ST.	10	1800	1800	3.81	68
8	FIFTH AVE. E.	THIRD ST.	8	1500	1500	3.65	66
9	FOURTH AVE. W.	FIRST ST.	8	2000	2000	2.74	53
10	SIXTH AVE. W.	SEVENTH ST.	5	1275	1275	2.69	52
11	THIRD AVE. W.	FIFTH ST.	7	1925	1925	2.49	49
12	FIRST AVE. W.	MONTANA ST.	10	3100	2925	2.34	47
13	FIRST AVE. W.	WASHINGTON ST	5	1850	1850	1.85	39
14	SECOND AVE. W.	FIRST ST.	9	3850	3632	1.70	36
15	FIRST AVE. W.	ELEVENTH ST.	20	8850	8349	1.64	35
16	SECOND AVE. W.	THIRD ST.	8	3850	3632	1.51	33
17	SECOND AVE. W.	SECOND ST.	10	7350	6934	0.99	23
18	FIFTH AVE. W.	MONTANA ST.	13	9700	9151	0.97	23
19	FIRST AVE. E.	MONTANA ST.	6	4850	4575	0.90	21
20	FIRST AVE. W.	TWELFTH ST.	6	4950	4670	0.88	21
21	FOURTH AVE. W.	CENTER ST.	10	9375	8844	0.77	19
22	WOODLAND DRIVE	SECOND ST.	15	14400	13585	0.76	18
23	MERIDIAN ROAD	TWO MILE ROAD	12	14250	13443	0.61	15
24	MERIDIAN ROAD	BUTTREY'S ACC	9	11650	10991	0.56	14
25	FIRST AVE. W.	CENTER ST.	9	13850	13066	0.47	12
		AVERAGE VALUE	10	5127	4871	2.69	47

TABLE 5. SITE RANKING BY ACCIDENT SEVERITY

RANK NO.	AVENUES	STREETS	SUM OF SEVERITY VALUES	TOTAL NO. ACC.	AVERAGE SEVERITY INDEX	INDICATOR VALUE
1	SIXTH AVE. W.	THIRD ST.	$116,000	9	$12,889	71
2	FIRST AVE. W.	TWELFTH ST.	$50,000	6	$8,333	60
3	MERIDIAN ROAD	BUTTREY'S ACCESS	$71,000	9	$7,889	59
4	SECOND AVE. W.	SECOND ST.	$67,000	10	$6,700	55
5	THIRD AVE. W.	FIFTH ST.	$41,000	7	$5,857	52
6	FIFTH AVE. E.	THIRD ST.	$43,000	8	$5,375	50
7	FIRST AVE. W.	ELEVENTH ST.	$107,000	20	$5,350	50
8	MERIDIAN ROAD	TWO MILE ROAD	$64,000	12	$5,333	50
9	FIRST AVE. W.	CENTER ST.	$47,000	9	$5,222	50
10	THIRD AVE. W.	THIRD ST.	$49,000	10	$4,900	49
11	THIRD AVE. W.	EIGHTH ST.	$32,000	7	$4,571	47
12	WOODLAND DRIVE	SECOND ST.	$66,000	15	$4,400	47
13	FOURTH AVE. W.	FIRST ST.	$34,000	8	$4,250	46
14	SECOND AVE. W.	EIGHTH ST.	$51,000	12	$4,250	46
15	SECOND AVE. W.	FIRST ST.	$38,000	9	$4,222	46
16	SECOND AVE. W.	MONTANA ST.	$76,000	19	$4,000	45
17	FIRST AVE. W.	WASHINGTON ST.	$19,000	5	$3,800	44
18	SIXTH AVE. W.	FIFTH ST.	$21,000	6	$3,500	43
19	FIFTH AVE. W.	MONTANA ST.	$44,000	13	$3,385	42
20	SECOND AVE. W.	FIFTH ST.	$25,000	8	$3,125	41
21	SECOND AVE. W.	THIRD ST.	$25,000	8	$3,125	41
22	FIRST AVE. W.	MONTANA ST.	$29,000	10	$2,900	40
23	FOURTH AVE. W.	CENTER ST.	$29,000	10	$2,900	40
24	FIRST AVE. E.	MONTANA ST.	$12,000	6	$2,000	34
25	SIXTH AVE. W.	SEVENTH ST.	$10,000	5	$2,000	34
		TOTAL SEVERITY $ =	$1,166,000			
		TOTAL NO. ACC. =		241		
		AVE. SEVERITY / ACC. =			$4,838	
		AVE. IND. VAL / SITE =				47

4. Volume to Capacity Ratio Indicator - This indicator not only reflects exposure rates but also incorporates existing street geometry, access and conditions such as traffic type, turning directions, volume mix and number of lanes. Computation of the volume capacity indicator is expressed as follows:

$$V/C = ADT/24\ HOUR\ CAPACITY$$

Modifications to the basic V/C formula were felt necessary because of the predominance of intersections within this study and the vast changes that have occurred in capacity theory since the time when the FHWA report was published. Use of the original formula would have diluted the relative importance of this indicator if calculated in this manner. Therefore, volume/capacity calculation using the 1985 Highway Capacity Manual procedures were used and expressed as a peak hour V/C. Calculations of peak hour V/C in this manner also gives an indication of intersection efficiency and aids in the development of potential improvements.

Data required for the volume capacity ratio involved field measurements of existing geometrics, turning counts and volume mix. The capacity of each intersection is computed through methodology presented in the 1985 *Highway Capacity Manual* using FHWA computer software. Although this indicator is cumbersome to use by inexperienced personnel, its inclusion is considered necessary and correlates well in hazardous index ranking.

Figure 9. presents a graphic plot of the volume capacity ratio versus the indicator value which is also scaled between 0 and 100. Table 6. is the computer generated ranking of the sites based on this indicator. The average value for this indicator was 40 while values ranged between 7 and 100.

TABLE 6. SITE RANKING BY VOLUME/CAPACITY RATIOS

RANK NO.	STREET/AVE	STREET/AVE	PEAK HOUR CAPACI	PEAK HOUR FLOW	* V/C RATIO	V/C INDICATOR VALUE
1	WOODLAND DRIVE	SECOND ST.	82	320	3.90	100
2	MERIDIAN ROAD	TWO MILE ROAD	203	216	1.06	100
3	FOURTH AVE. W.	CENTER ST.	309	189	0.61	88
4	SECOND AVE. W.	SECOND ST.	*	*	0.44	70
5	FIFTH AVE. W.	MONTANA ST.	378	162	0.43	69
6	FIRST AVE. W.	ELEVENTH ST.	468	199	0.43	69
7	FIRST AVE. W.	CENTER ST.	**	**	0.37	62
8	MERIDIAN ROAD	BUTTREY'S ACCESS	409	131	0.32	56
9	FIRST AVE. E.	MONTANA ST.	775	233	0.30	54
10	SECOND AVE. W.	FIRST ST.	858	186	0.22	43
11	SECOND AVE. W.	THIRD ST.	727	150	0.21	42
12	FIRST AVE. W.	TWELFTH ST.	847	145	0.17	36
13	FIRST AVE. W.	MONTANA ST.	743	99	0.13	31
14	SECOND AVE. W.	MONTANA ST.	687	63	0.09	24
15	FIRST AVE. W.	WASHINGTON ST.	900	75	0.08	22
16	THIRD AVE. W.	THIRD ST.	812	54	0.07	19
17	FOURTH AVE. W.	FIRST ST.	824	43	0.05	16
18	SECOND AVE. W.	FIFTH ST.	871	44	0.05	15
19	SIXTH AVE. W.	FIFTH ST.	915	45	0.05	15
20	THIRD AVE. W.	FIFTH ST.	854	40	0.05	15
21	FIFTH AVE. E.	THIRD ST.	899	35	0.04	13
22	SIXTH AVE. W.	SEVENTH ST.	885	31	0.04	12
23	SIXTH AVE. W.	THIRD ST.	920	23	0.03	9
24	SECOND AVE. W.	EIGHTH ST.	919	19	0.02	8
25	THIRD AVE. W.	EIGHTH ST.	925	16	0.02	7
		AVERAGE VALUES	648	101	0.37	40

* V/C Refers to capacity of the minor street in the case of uncontrolled or stop/yeild controlled intersections.

** V/C Refers to average v/c for all legs of signalized intersection or a four way stop intersection.

5. Sight Distance Indicator - This indicator is of significant value in both rural and urban locations, especially at intersections. Even though the weighting factor in the hazard index computation is low, it is still considered valuable in determining cause and effect relationships and other deficiencies at the accident cluster sites.

The data format for using the sight distance indicator is the ratio of actual sight distance to desirable sight distance. The FHWA report presents the minimum stopping sight distance on wet pavement for the various design speeds. Actual stopping sight distance is the distance from the drivers position to the point where a stop may be required to avoid a hazardous maneuver or direct collision. Required sight distances vary according to the type of control encountered. At uncontrolled intersections specific AASHTO guidelines for this situation are used. At stop controlled and signalized intersections two different requirements are applied: 1. stopping sight distance to the control device & 2. intersection sight distance required to cross the intersection. The various required sight distances and measured values are computed and combined according to the study method's formulation to determine the indicator value.

The data format for this indicator is the sight distance ratio of actual over desirable. Collection of the sight distance data requires field measurements of sight distance and determination of average travel speeds. Figure 10. presents a graphic plot of the sight distance ratio versus the indicator value which ranges from 0 to 100. Table 7. is the computer generated ranking of sites based on this indicator. A total of 13 sites had indicator values of 100 and they ranged down to 35. Considering all of the possible restrictions present in an urban environment, the higher values should not be unexpected.

TABLE 7. SITE RANKING BY SIGHT DISTANCE

RANK NO.	INTERSECTION LOCATION		APP1 SD	REQ SD	RATIO	APP2 SD	REQ SD	RATIO	APP3 SD	REQ SD	RATIO	APP4 SD	REQ SD	RATIO	*WT. IND VAL
1	SECOND AVE. W.	MONTANA ST.	40	200	0.20	90	200	0.45	140	300	0.47	140	300	0.47	100
2	FIRST AVE. W.	WASHINGTON	50	200	0.25	100	200	0.50	120	300	0.40	130	300	0.43	100
3	MERIDIAN ROAD	BUTTREY'S AC	80	300	0.27	300	300	1.00	80	200	0.40	0	0	ERR	100
4	SECOND AVE. W.	SECOND ST.	60	200	0.30	80	200	0.40	80	200	0.40	150	200	0.75	100
5	MERIDIAN ROAD	TWO MILE ROA	150	475	0.32	180	475	0.38	300	275	1.09	80	200	0.40	100
6	WOODLAND DRIV	SECOND ST.	110	300	0.37	140	400	0.35	90	200	0.45	240	200	1.20	100
7	SECOND AVE. W.	THIRD ST.	70	200	0.35	80	200	0.40	140	300	0.47	140	300	0.47	100
8	FIFTH AVE. W.	MONTANA ST.	100	200	0.50	140	200	0.70	140	400	0.35	140	400	0.35	100
9	FOURTH AVE. W.	CENTER ST.	100	200	0.50	80	200	0.40	220	400	0.55	260	400	0.65	100
10	SECOND AVE. W.	FIRST ST.	80	200	0.40	130	200	0.65	160	300	0.53	240	300	0.80	100
11	FIRST AVE. W.	ELEVENTH ST.	150	300	0.50	150	300	0.50	100	200	0.50	100	200	0.50	100
12	FIRST AVE. W.	TWELFTH ST.	150	300	0.50	150	300	0.50	100	200	0.50	100	200	0.50	100
13	THIRD AVE. W.	THIRD ST.	80	110	0.73	90	110	0.82	90	110	0.82	100	110	0.91	100
14	FIRST AVE. E.	MONTANA ST.	180	200	0.90	180	200	0.90	120	300	0.40	260	300	0.87	95
15	FIRST AVE. W.	MONTANA ST.	75	110	0.68	70	110	0.64	80	110	0.73	90	110	0.82	75
16	FIFTH AVE. E.	THIRD ST.	70	110	0.64	80	110	0.73	110	110	1.00	110	110	1.00	72
17	SIXTH AVE. W.	FIFTH ST.	70	110	0.64	80	110	0.73	90	110	0.82	110	110	1.00	72
18	SECOND AVE. W.	EIGHTH ST.	70	110	0.64	70	110	0.64	100	110	0.91	100	110	0.91	63
19	SIXTH AVE. W.	THIRD ST.	70	110	0.64	70	110	0.64	110	110	1.00	110	110	1.00	59
20	FOURTH AVE. W.	FIRST ST.	90	110	0.82	80	110	0.73	80	110	0.73	120	110	1.09	59
21	SECOND AVE. W.	FIFTH ST.	80	110	0.73	110	110	1.00	110	110	1.00	110	110	1.00	51
22	THIRD AVE. W.	FIFTH ST.	90	110	0.82	100	110	0.91	100	110	0.91	100	110	0.91	48
23	FIRST AVE. W.	CENTER ST.	180	200	0.90	300	200	1.50	400	275	1.45	300	275	1.09	37
24	SIXTH AVE. W.	SEVENTH ST.	110	110	1.00	110	110	1.00	110	110	1.00	140	110	1.27	35
25	THIRD AVE. W.	EIGHTH ST.	110	110	1.00	110	110	1.00	110	110	1.00	110	110	1.00	35
														AVERAGE INDICATOR VALUE	80.0

6. Driver Expectancy Indicator - This indicator relates human behavior factors to existing road conditions. The value of this indicator is realized in the fact that the roadway geometrics and roadside culture are evaluated on a human judgement basis.

The data format for the driver expectancy index is the problem rating scale. Being a subjective indicator, the degree of expectancy is rated on a scale from 1 to 6, and the expectancy rating varies linearly with the indicator value as shown in Figure 11. The expectancy rating form can be found in the FHWA report for further reference. Table 8. is the computer generated ranking of sites based on this indicator.

7. Information System Deficiencies Indicator - This indicator also provides a value or subjective judgement on the sufficiency of traffic control devices which transfer necessary information to the operator.

The data format for the information system deficiencies indicator is similar to that of the driver expectancy indicator in that a value form is used to provide a rating between 1 and 6. The rating for this indicator is also plotted linearly between the indicator range values of 0 and 100 and is shown on Figure 12. The value rating form is for the information system deficiencies indicator. It is also presented in the FHWA report for further reference. Table 9. is the computer generated ranking of sites based on this indicator.

TABLE 8. SITE RANKING BY DRIVER EXPECTANCY

RANK NO.	AVENUE	STREET	NB RATE	SB RATE	EB RATE	WB RATE	WGTD. RATE	IND VAL
1	FIRST AVE. W.	MONTANA ST.	6	6	6	6	6.0	100
2	MERIDIAN ROAD	BUTTREY'S ACCESS	6	6		5	5.7	94
3	SECOND AVE. W.	FIRST ST.	5	6	6	5	5.5	92
4	SECOND AVE. W.	THIRD ST.	6	6	5	5	5.5	92
5	MERIDIAN ROAD	TWO MILE ROAD	5	5	6	6	5.5	92
6	WOODLAND DRIVE	SECOND ST.	5	6	5	5	5.3	88
7	FIRST AVE. E.	MONTANA ST.	5	5	5	5	5.0	83
8	FOURTH AVE. W.	CENTER ST.	4	4	5	5	4.5	75
9	SECOND AVE. W.	SECOND ST.	5	5	4	4	4.5	75
10	FIRST AVE. W.	CENTER ST.	5	6	3	3	4.3	71
11	FIFTH AVE. W.	MONTANA ST.	5	5	3	3	4.0	67
12	FIRST AVE. W.	TWELFTH ST.	5	5	3	3	4.0	67
13	FIRST AVE. W.	ELEVENTH ST.	4	5	3	3	3.8	63
14	SIXTH AVE. W.	THIRD ST.	3	4	4	3	3.5	58
15	SIXTH AVE. W.	SEVENTH ST.	4	3	4	3	3.5	58
16	SIXTH AVE. W.	FIFTH ST.	4	4	3	3	3.5	58
17	FOURTH AVE. W.	FIRST ST.	4	4	3	3	3.5	58
18	THIRD AVE. W.	THIRD ST.	3	3	4	4	3.5	58
19	SECOND AVE. W.	FIFTH ST.	4	4	3	3	3.5	58
20	THIRD AVE. W.	FIFTH ST.	3	3	4	4	3.5	58
21	FIRST AVE. W.	WASHINGTON ST.	4	3	3	3	3.3	54
22	THIRD AVE. W.	EIGHTH ST.	3	3	4	3	3.3	54
23	FIFTH AVE. E.	THIRD ST.	3	3	3	3	3.0	50
24	SECOND AVE. W.	EIGHTH ST.	3	3	3	3	3.0	50
25	SECOND AVE. W.	MONTANA ST.	2	2	2	2	2.0	33
						AVERAGE INDICATOR VALUE =		68.3

TABLE 9. SITE RANKING BY INFORMATION DEFICIENCY

RANK NO.	STREET/AVE	STREET/AVE	NB RATE	SB RATE	EB RATE	WB RATE	WGTD. RATE	IND VAL
1	THIRD AVE. W.	FIFTH ST.	6	6	6	6	6.0	100
2	FIRST AVE. W.	MONTANA ST.	6	6	6	6	6.0	100
3	MERIDIAN ROAD	BUTTREY'S ACC	6	6		6	6.0	100
4	FIRST AVE. E.	MONTANA ST.	6	6	5	5	5.5	92
5	WOODLAND DRIVE	SECOND ST.	4	6	5	4	4.8	79
6	FOURTH AVE. W.	CENTER ST.	5	6	4	4	4.8	79
7	MERIDIAN ROAD	TWO MILE ROAD	4	4	5	6	4.8	79
8	SECOND AVE. W.	THIRD ST.	5	5	4	4	4.5	75
9	SECOND AVE. W.	FIRST ST.	6	6	3	3	4.5	75
10	FIRST AVE. W.	TWELFTH ST.	5	5	4	3	4.3	71
11	FIRST AVE. W.	ELEVENTH ST.	5	5	3	3	4.0	67
12	FIFTH AVE. W.	MONTANA ST.	5	5	3	3	4.0	67
13	SIXTH AVE. W.	SEVENTH ST.	4	4	4	4	4.0	67
14	FOURTH AVE. W.	FIRST ST.	5	5	3	3	4.0	67
15	FIRST AVE. W.	CENTER ST.	4	5	3	3	3.8	63
16	SIXTH AVE. W.	FIFTH ST.	4	4	3	3	3.5	58
17	SIXTH AVE. W.	THIRD ST.	4	4	3	3	3.5	58
18	FIFTH AVE. E.	THIRD ST.	4	4	3	3	3.5	58
19	SECOND AVE. W.	EIGHTH ST.	4	4	3	3	3.5	58
20	SECOND AVE. W.	FIFTH ST.	4	4	3	3	3.5	58
21	THIRD AVE. W.	EIGHTH ST.	4	4	3	3	3.5	58
22	THIRD AVE. W.	THIRD ST.	4	4	3	3	3.5	58
23	FIRST AVE. W.	WASHINGTON ST	4	3	3	3	3.3	54
24	SECOND AVE. W.	SECOND ST.	3	3	3	4	3.3	54
25	SECOND AVE. W.	MONTANA ST.	2	3	4	4	3.3	54
			AVERAGE INDICATOR VALUE =					70.0

HAZARD RANKING

Once all of the data had been collected and the indicator values computed, indicator values and necessary data were transferred to the hazard index computation matrix. Each indicator was weighted in accordance with the FHWA report. The weighting factors are fractional portions of unity. When all nine indicators established in FHWA report are used, the sum of weights is equal to one. In the case of Kalispell, two indicators were omitted, the Traffic Conflict Indicator and the Erratic Maneuvers Indicator. Their exclusion from the study was not felt to be any detriment in the ranking of hazardous sites. The use of seven indicators provided an 88.6% confidence in strength of evaluation.

Based on the hazard analysis for each site, a matrix of indicator values and final hazard index ratings was constructed on a Quattro Pro template and a hazard index ranking was completed. Table 10., on the following page, lists this ranking by site number, location, indicator values and hazard index. Also shown is statistical information for the indicator values and hazard index.

TABLE 10. SITE RANKING BY HAZARD INDEX - SUMMARY OF INDICATOR VALUES

RANK NO.			# OF ACC. IND VAL	# OF ACC. PART H.I. Wgt. 16.4%	ACC. RATE IND VAL	ACC. RATE PART H.I. Wgt. 22.5%	SEVERITY IND VAL	SEVERITY PART H.I. Wgt. 19.1%	V/C RATIO IND VAL	V/C RATIO PART H.I. Wgt. 8.2%	SIGHT DIST IND VAL	SIGHT DIST PART H.I. Wgt. 7.4%	EXPECT. IND VAL	EXPECT. PART H.I. Wgt. 14.9%	INFO DEF. IND VAL	INFO DEF. PART H.I. Wgt. 11.5%	TOTAL HAZARD INDEX Wgt 100%
1	SIXTH AVE. W.	THIRD ST.	64	10.4	100	22.4	71	13.5	9	0.7	59	4.4	58	8.6	58	6.7	66.7
2	FIRST AVE. W.	MONTANA ST.	67	10.9	47	10.5	40	7.6	31	2.5	100	7.4	100	14.8	100	11.5	65.3
3	WOODLAND DRIVE	SECOND ST.	78	12.7	18	4.0	47	8.9	100	8.2	100	7.4	88	13.0	79	9.1	63.4
4	MERIDIAN ROAD	TWO MILE ROAD	72	11.7	15	3.4	50	9.5	100	8.2	100	7.4	92	13.6	79	9.1	62.9
5	MERIDIAN ROAD	BUTTREY'S ACCESS	64	10.4	14	3.1	59	11.2	56	4.6	100	7.4	94	13.9	100	11.5	62.2
6	SECOND AVE. W.	EIGHTH ST.	72	11.7	99	22.2	46	8.7	8	0.7	63	4.7	50	7.4	58	6.7	62.0
7	FIRST AVE. W.	ELEVENTH ST.	85	13.9	35	7.8	50	9.5	69	5.7	100	7.4	63	9.3	67	7.7	61.3
8	SECOND AVE. W.	FIRST ST.	64	10.4	36	8.1	46	8.7	43	3.5	100	7.4	92	13.6	75	8.6	60.4
9	SECOND AVE. W.	MONTANA ST.	84	13.7	76	17.0	45	8.6	24	2.0	100	7.4	33	4.9	54	6.2	59.7
10	THIRD AVE. W.	THIRD ST.	67	10.9	68	15.2	49	9.3	19	1.6	100	7.4	58	8.6	58	6.7	59.7
11	THIRD AVE. W.	EIGHTH ST.	58	9.5	100	22.4	47	8.9	7	0.6	35	2.6	54	8.0	58	6.7	58.6
12	SECOND AVE. W.	THIRD ST.	61	9.9	33	7.4	41	7.8	42	3.4	100	7.4	92	13.6	75	8.6	58.2
13	FOURTH AVE. W.	CENTER ST.	67	10.9	19	4.3	40	7.6	88	7.2	100	7.4	75	11.1	79	9.1	57.6
14	SECOND AVE. W.	SECOND ST.	67	10.9	23	5.2	55	10.5	70	5.7	100	7.4	75	11.1	54	6.2	57.0
15	SIXTH AVE. W.	FIFTH ST.	54	8.8	77	17.2	43	8.2	15	1.2	72	5.3	58	8.6	58	6.7	56.0
16	FIFTH AVE. W.	MONTANA ST.	74	12.1	23	5.2	42	8.0	69	5.7	100	7.4	67	9.9	67	7.7	55.9
17	THIRD AVE. W.	FIFTH ST.	58	9.5	49	11.0	52	9.9	15	1.2	48	3.6	58	8.6	100	11.5	55.2
18	SECOND AVE. W.	FIFTH ST.	61	9.9	75	16.8	41	7.8	15	1.2	51	3.8	58	8.6	58	6.7	54.8
19	FIFTH AVE. E.	THIRD ST.	61	9.9	66	14.8	50	9.5	13	1.1	72	5.3	50	7.4	58	6.7	54.7
20	FIRST AVE. E.	MONTANA ST.	54	8.8	21	4.7	34	6.5	54	4.4	95	7.0	83	12.3	92	10.6	54.3
21	FIRST AVE. W.	TWELFTH ST.	54	8.8	21	4.7	60	11.4	36	3.0	100	7.4	67	9.9	71	8.2	53.3
22	FOURTH AVE. W.	FIRST ST.	61	9.9	53	11.9	46	8.7	16	1.3	59	4.4	58	8.6	67	7.7	52.5
23	FIRST AVE. W.	WASHINGTON ST.	50	8.2	39	8.7	44	8.4	22	1.8	100	7.4	54	8.0	54	6.2	48.7
24	FIRST AVE. W.	CENTER ST.	64	10.4	12	2.7	50	9.5	62	5.1	37	2.7	71	10.5	63	7.2	48.2
25	SIXTH AVE. W.	SEVENTH ST.	50	8.2	52	11.6	34	6.5	12	1.0	35	2.6	58	8.6	67	7.7	46.1
	AVERAGE VALUES =		64		47		47		40		81		68		70		57
	STANDARD DEVIATIONS =		9		28		8		29		24		17		15		5

EXPLANATION OF IMPROVEMENTS

The recommended improvements presented within this report are short term improvements which reflect the minimum amount of upgrading or modifications necessary to increase driver expectancy and to update the sites to current standards. Long term improvements are only considered viable when severe conditions at the site prevent short term improvements from completely satisfying the control measures necessary to significantly reduce future problems. Since any long term improvements would be dependant upon significant changes in future traffic operations and most of the sites of this nature would be covered by the transportation plan, no specific plans were advanced and no costs or project ranking was completed for long term improvements. However, general recommendations of a long term nature are made within the site specific section when applicable.

Some of the recommended improvements have sufficient latitude so that alternative measures could be suggested during design. The selection of recommended improvements was based on subjective engineering judgement and current traffic control standards. Basis of the recommendations incorporate an understanding of driver psychology, visual input requirements, accident statistics and comparative studies. Some of the recommended improvements may not be directly related to accident prevention, but are required to meet current standards and provide consistent control measures. Specific reasons for recommendations are presented in the site specific section of this report.

Prior to subjecting the proposed improvements to review based on the status quo, it should be remembered that these study sites are probably not characteristic of all Kalispell intersections. They have been documented as the highest accident locations in the City, with exception of federal aid designated streets. As such, they require improvement measures not typical of other area intersections. If recommended improvements call for 36" stop signs and centerline striping, it should not be considered as justification for installing larger stop signs or striping centerlines at all other locations. In most cases, 30" stop signs are completely adequate while in

some cases, either because of sight restrictions; visual distractions on the horizon; lighting conditions or other various reasons, stop signs are simply not perceived by the driver. Recommendations for oversize stop signs in this study are made when a visual obstruction is not apparent but there is strong evidence that the stop sign is not being perceived.

Since all of the study sites are recognized accident cluster locations, there is good statistical probability that the majority of accidents are not by chance. Therefore, street and traffic control conditions are likely deficient for expected traffic operations. Some of the deficiencies are entirely obvious once the facts have been examined. Others defy a clear cut answer with regard to cause and effect relationships. In all cases, improvements are geared toward improving the street system by relating to the driver's cognitive abilities. The first means of accomplishing this is to enhance visual perception by insuring a clear line of sight to all important information sources, ie. approaching vehicles and traffic control devices. The second factor related to driving functions is directed at subconscious perception, which is the major factor in driver expectancy. As an example, if a street section appears to be a thru street based on visual clues such as wide pavement surfaces, minor side street traffic and an uninterrupted view to the horizon, even over-sized stop signs may be ignored. In this case, disruption of the pattern is required. It may take the form of a stop bar, cross walk or centerline striping at a stop controlled intersection. These are all methods of giving visual clues to the driver which subconsciously indicates that the approaching intersection requires actions different than did the previous intersections. Many of the recommended improvements within this study relate to the later means of providing information to the driver.

Recommendations for plastic pavement markings are replete throughout the study. Painted marks may be substituted to substantially reduce the City's cost. However, more intense maintenance will be needed if this alternative is chosen. If the marks are worn most of the time, they will not functioned as planned.

In two cases, a yield sign is recommended rather than a stop sign. There are many factors influencing this decision. The most important factor is sight distance. If there is a permanent sight obstruction such as a building, yield signs are not considered because their use assumes ability to perceive and react to a potential conflict similar to an uncontrolled intersection. When permanent sight obstructions do not exist, all mobile obstructions (parked vehicles) must be moved from the clear vision zone and yield signs can then be recommended as a first level improvement. Low traffic volumes at several other intersection within this study could easily be controlled by yield signs if were not for permanent sight obstructions consisting of houses and other buildings. The minimum required sight distance for vehicles traveling at 25 mph entering an uncontrolled intersection is 110 feet on all approach legs. The same distance is required for yield controlled intersections, according to AASHTO. When these minimum distances cannot be achieved, yield control is not an option. In the case of this study, all intersections which cannot meet the minimum sight distance requirements must necessarily be upgraded to a stop condition. Therefore, almost all recommendations include installation of stop signs.

Judging from street system characteristics in Kalispell, most intersections would require stop control. This does not mean that the city should install stop signs at every intersection. Other conditions may exist throughout the remainder of the city which would preclude the use of stop signs. The study sites happen to be known problem areas for which extra measures need to be implemented.

In many urban areas, there appears to be a perception that stop signs are undesirable because they create thru streets. In some cases, this perception may be correct. However, traffic demand must initially be present before stop control could affect traffic patterns to any extent and side street stop control must be implemented extensively along a street to affect travel times to any degree. In the same vein, stop signs should never be used to prevent a street from being utilized as a thru route. Installation of stops signs on the higher volume leg of an intersection does not effectively reduce travel time and only serves to create disrespect for the sign and increases accidents. Within this study all attempts were made to coordinate stop signs with existing stop signs in the surrounding area, but volumes and function were primary considerations in the recommended locations. When vol-

umes and functions were approximately equal on all legs, potential vision conflicts were used to decide stop sign location.

At some sites which already have stop signs, it was recommended that the stop signs be moved to the opposite legs of the intersection. The major reason for this recommendation was to stop the minor traffic volume leg. It was felt that much of the accident experience could be attributed to misapplication of the stop signs. Experience has shown that installation of stop control on the major legs of an intersection degrades safety and makes drivers loose respect for stop signs. Drivers who routinely enter an intersection without seeing other vehicles on the side approach, become accustomed to not stopping at inappropriately placed stop signs. After a period of time, the stop signs actually become invisible to the conscious mind and accident potential increases. It has been shown that accident rates at intersections with stop signs on the major leg can be more than double the rate at intersections that stop the minor leg.

The improvement sketches, in some cases should not be considered design plans. Some of the more complex drawings are preliminary and are intended to present improvement concepts only in enough detail to provide the measure of control necessary and to provide cost estimates. In some cases, detailed survey data; design analysis; design plans and specifications; and construction layout will be necessary to effectively achieve the improvements.

Signal warrant analysis was completed at some of the higher volume intersections. In two cases where existing traffic signals did not exist, existing conditions met at least one of the eleven traffic signal warrants. After careful consideration of the operations and alternative improvements at these intersections, it was decided to recommend traffic signals along with other required improvements. Further data and analysis may be required at these locations to verify the warranting conditions prior to project implementation.

BENEFIT/COST RATIOS

COSTS

Preliminary cost estimates are developed by applying unit costs to required quantities based either on current prices as tabulated from average bid prices of similar projects or, where applicable, on prices established by Montana Department of Transportation's Project Planning Section. The costs should in no way be considered a quote or final estimate of actual work.

The following are traffic control devices and allowable costs that are currently eligible for funding by the Montana Department of Transportation through their Off-System Safety Program:

A. Signs:

1. 1 square foot to 6 square feet - $ 100.00
2. 6.1 square feet to 10 square feet - $ 140.00
3. 10.1 square feet to 20 square feet - $ 170.00
4. supplementary sign on same post - $ 50.00

B. Delineators:

1. Design ""A" metal posts - $ 9.25
2. Design "A" flexible posts-6' - $ 20.00
3. Design "A" flexible posts-27" - $ 6.00

C. Guardrail:

1. New "W" Beam rail (per foot) - $ 8.00
2. "W" Beam end treatment (each) - $ 1,000.00
3. New concrete rail (per foot) - $ 16.00
4. New concrete end tapers (per foot) - $ 16.00

D. Pavement Markings:

1. Pavement Marking Paint (per gal) - $ 15.00
*2. Pavement Marking Plastic (per S.F.) - $ 3.00
*3. Plastic Words & Symbols (per S.F.) - $ 2.00

The Department of Justice and the Montana Department of Transportation are currently evaluating safety improvement costs within urban environments. Since the above noted items do not adequately correlate with the nature of improvements within highly urbanized areas, other funding schemes are now being considered. The plastic pavement marking costs*, listed above, are only an estimate based on current unit bid prices and have not been formally established by MDoT.

Even though Kalispell street and traffic crews are capable of performing a good deal of work, costs related to physical changes in the roadway section and traffic signal installations are based on contract prices in order to correlate with costs requiring contract bid letting. The costs do not include administrative, engineering or field layout for the recommended improvements at sites which would require final design plans. Engineering design will generally be required to produce contract plans and specifications. These costs should be evaluated prior to planning improvement projects requiring bids.

BENEFITS

Estimated benefits are made by applying accident reduction forecasts based on the type of improvement recommended. The forecasts are based on the subjective evaluation by an experienced traffic engineer. This evaluation is aided by knowledge of accident experience at similar locations with the improvements existing. Also statistical studies relating certain improvements to accident reduction are used as a guide ie, Roy Jorgenson and Associates, *"Evaluation of Criteria for Safety Improvements on the Highway" (Washington, D.C.: U.S. Bureau of Public Roads, Office of Highway Safety, 1966. p. 316).*

The forecasted reduction is expressed as a percentage of each type of accident. This percentage is multiplied by the percentage of all accidents represented by

each type. The total percent reduction of all accidents at each site is the sum of all accidents reduction percentages for each type.

The method used to compute benefits in this study follows the Montana Department of Transportation's procedures. Those procedures were programmed by Marvin & associates for Quattro Pro Computer Software which provides a tabular summary of all variables in the computation.

If applied consistently, the economic benefit computation will provide a realistic estimate of average economic savings to society. The benefit amount should not be interpreted as a dollar value that Kalispell will receive as a result of dollar outlay. It is a figure used to quantify the economic benefit to society that would occur if a certain number of accidents did not occur.

B/C RATIO

The B/C provides a numerical reference to the relative value of the recommended improvements. It is the desire of any improvement project to have a benefit/cost (B/C) ratio in excess of 1.0. If the B/C is less than 1.0 the project would have questionable justification. In this study, one of the sites had a B/C less than one, but in this case significant savings in delay could easily increase the B/C ratio above one, if efficiency benefits were included in the calculation.

Table 11 is a computer generated summary of the B/C ranking for the twenty five study sites. From this table, it can be seen that the total capital cost of improvements would be approximately $ 279,000 or about $11,200 per site. The total projected benefit would be approximately $ 202,800, annually. The average B/C ratio value was computed to be approximately 14, which translates into a 1400% return on investment.

B/C indicator values ranged between -8 and 100. The average value for all sites was 43. An explanation of the B/C indicator value is given in the priority index section of this report.

TABLE 11. SITE RANKING BY BENEFIT/COST RATIOS

RNK #	SITE LOCATION		PRO LIFE	COSTS: CAPITOL COST IMPROVE	COSTS: EQUIV ANNUAL COST	COSTS: ANNUAL MAINT. COST CH.	COSTS: TOTAL ANNUAL COST	BENEFITS: Q	Afi	Apd	PFI	Ppd	BENEFITS: ANNUAL BENEFIT	B/C RATIO	IND VAL
1	SIXTH AVE. W.	THIRD ST.	5	$825	$218	$70	$288	$18,150	2.50	0.75	60%	60%	$28,458	98.94	100
2	THIRD AVE. W.	EIGHTH ST.	5	$470	$124	$40	$164	$18,150	0.50	1.25	60%	51%	$6,529	39.82	80
3	THIRD AVE. W.	THIRD ST.	5	$840	$222	$50	$272	$18,150	0.75	2.00	60%	60%	$10,167	37.43	79
4	FIFTH AVE. E.	THIRD ST.	5	$1,260	$332	$80	$412	$18,150	0.75	1.25	70%	70%	$11,058	26.82	71
5	SECOND AVE. W.	EIGHTH ST.	5	$825	$218	$50	$268	$18,150	0.75	2.25	40%	40%	$6,931	25.90	71
6	FIRST AVE. W.	ELEVENTH ST.	5	$3,515	$927	$250	$1,177	$18,150	1.75	3.75	53%	60%	$20,613	17.51	62
7	SECOND AVE. W.	FIFTH ST.	5	$825	$218	$50	$268	$18,150	0.25	1.75	60%	53%	$4,196	15.68	60
8	SECOND AVE. W.	MONTANA ST.	5	$565	$149	$50	$199	$18,150	1.00	4.00	10%	10%	$2,463	12.38	55
9	FOURTH AVE. W.	FIRST ST.	15	$4,000	$526	$100	$626	$18,150	0.50	1.50	60%	54%	$6,793	10.85	52
10	MERIDIAN ROAD	BUTTREY'S ACC	15	$14,110	$1,855	$50	$1,905	$18,150	1.25	2.00	80%	69%	$20,625	10.83	52
11	SIXTH AVE. W.	FIFTH ST.	5	$1,030	$272	$60	$332	$18,150	0.25	1.25	50%	50%	$3,270	9.86	50
12	THIRD AVE. W.	FIFTH ST.	7	$3,540	$727	$250	$977	$18,150	0.75	1.00	60%	60%	$9,249	9.47	49
13	FIRST AVE. W.	MONTANA ST.	15	$4,904	$645	$100	$745	$18,150	0.25	2.25	70%	70%	$5,650	7.59	44
14	FIRST AVE. W.	TWELFTH ST.	5	$3,095	$816	$250	$1,066	$18,150	1.00	0.75	40%	50%	$7,979	7.48	44
15	SECOND AVE. W.	FIRST ST.	5	$1,805	$476	$150	$626	$18,150	0.50	2.00	35%	40%	$4,464	7.13	43
16	SECOND AVE. W.	SECOND ST.	5	$2,185	$576	$180	$756	$18,150	1.25	1.50	20%	15%	$4,973	6.57	41
17	SECOND AVE. W.	THIRD ST.	15	$5,307	$698	$175	$873	$18,150	0.25	1.75	40%	45%	$3,056	3.50	27
18	FIFTH AVE. W.	MONTANA ST.	5	$4,494	$1,186	$300	$1,486	$18,150	0.50	2.75	30%	48%	$4,797	3.23	25
19	FIRST AVE. W.	WASHINGTON S	5	$825	$218	$80	$298	$18,150	0.25	1.00	15%	15%	$924	3.10	25
20	FIRST AVE. E.	MONTANA ST.	5	$950	$251	$75	$326	$18,150	0.00	1.50	0%	40%	$918	2.82	23
21	FOURTH AVE. W.	CENTER ST.	15	$9,809	$1,290	$150	$1,440	$18,150	0.25	2.25	40%	41%	$3,263	2.27	18
22	SIXTH AVE. W.	SEVENTH ST.	5	$1,695	$447	$100	$547	$18,150	0.00	1.25	0%	50%	$956	1.75	12
23	WOODLAND DRIVE	SECOND ST.	15	$86,492	$11,371	$1,500	$12,871	$18,150	1.00	2.75	73%	70%	$16,460	1.28	5
24	MERIDIAN ROAD	TWO MILE ROA	15	$80,986	$10,648	$1,500	$12,148	$18,150	1.00	2.50	70%	48%	$14,795	1.22	4
25	FIRST AVE. W.	CENTER ST.	17	$44,542	$5,553	$500	$6,053	$18,150	0.75	1.75	20%	54%	$4,223	0.70	-8
	TOTALS :			$278,894	$39,961	$6,160	$46,121						$202,810		
	AVERAGES :		8.36	$11,156	$1,598	$246	$1,845				45%	49%	$8,112	14.56	43

PRIORITY INDEX

The ranking of site improvement priorities cannot be directly dependent on the hazard ranking of the study sites. The value of the improvements must enter into the priority listing in the form of the benefit/cost ratio (B/C). The method of developing a composite Hazard Index - B/C listing must be dependent on the relative index scale used in the hazard index computation. Therefor, a correlation of scale between the B/C ratio and hazard indicator value was developed on the following assumptions:

1. The contributing conditions creating hazards at each site and the resulting hazard ranking is relatively independent of the cost of correcting these conditions.
2. Benefits to be derived from correcting hazardous situations at each site is indirectly proportional to the degree of hazards encountered.
3. The benefit/cost ratio, by virtue of benefit computation, is indirectly proportional to the number of accidents indicator and severity indicator, both of which are curvilinear functions.
4. The benefit/cost ratios can be rated on a scale of 0 to 100 based on a curvilinear function.
5. The B/C ratio of 1.0 is equivalent to an indicator value of 0 and the upper limit (indicator value = 100) must be chosen to encompass the majority of sites.

In this case, a B/C of 100.0 and above assumes the indicator value of 100. Based on these assumptions a graphic plot of the B/C ratio versus B/C indicator value has been established and it is shown in Figure 13. Since it has been graphed on semi-log paper the line appears linear.

Since the relative weighting of benefit/costs and hazard indexes is a controversial subject which would require research beyond the scope of this report, it is felt that the priority index should be based on 33% weighting for the benefit/cost ratio and 67% weight on the hazard index. Therefore, to establish a priority index the following formula has been devised:

Priority Index = (Hazard Index) x (0.67)
+ (Benefit/Cost Indicator) x (0.33)

Table 12. is the computer generated summary of priority ranking based on the composite hazard index - benefit/cost index values.

TABLE 12. SITE RANKING BY PRIORITY INDEX - SUMMARY

PRIORITY NUMBER	AVENUE	STREET	HAZARD INDEX	WEIGHTED VALUE	BEN/CO INDEX	WEIGHTED VALUE	PRIORITY INDEX
1	SIXTH AVE. W.	THIRD ST.	66.70	44.69	100	33.00	77.69
2	THIRD AVE. W.	THIRD ST.	59.70	40.00	79	26.07	66.07
3	THIRD AVE. W.	EIGHTH ST.	58.60	39.26	80	26.40	65.66
4	SECOND AVE. W.	EIGHTH ST.	62.00	41.54	71	23.43	64.97
5	FIRST AVE. W.	ELEVENTH ST.	61.30	41.07	62	20.46	61.53
6	FIFTH AVE. E.	THIRD ST.	54.70	36.65	71	23.43	60.08
7	MERIDIAN ROAD	BUTTREY'S ACC	62.20	41.67	52	17.16	58.83
8	FIRST AVE. W.	MONTANA ST.	65.30	43.75	44	14.52	58.27
9	SECOND AVE. W.	MONTANA ST.	59.70	40.00	55	18.15	58.15
10	SECOND AVE. W.	FIFTH ST.	54.80	36.72	60	19.80	56.52
11	SECOND AVE. W.	FIRST ST.	60.40	40.47	43	14.19	54.66
12	SIXTH AVE. W.	FIFTH ST.	56.00	37.52	50	16.50	54.02
13	THIRD AVE. W.	FIFTH ST.	55.20	36.98	49	16.17	53.15
14	FOURTH AVE. W.	FIRST ST.	52.50	35.18	52	17.16	52.34
15	SECOND AVE. W.	SECOND ST.	57.00	38.19	41	13.53	51.72
16	FIRST AVE. W.	TWELFTH ST.	53.30	35.71	44	14.52	50.23
17	SECOND AVE. W.	THIRD ST.	58.20	38.99	27	8.91	47.90
18	FIFTH AVE. W.	MONTANA ST.	55.90	37.45	25	8.25	45.70
19	FOURTH AVE. W.	CENTER ST.	57.60	38.59	18	5.94	44.53
20	WOODLAND DRIVE	SECOND ST.	63.40	42.48	5	1.65	44.13
21	FIRST AVE. E.	MONTANA ST.	54.30	36.38	23	7.59	43.97
22	MERIDIAN ROAD	TWO MILE ROAD	62.90	42.14	4	1.32	43.46
23	FIRST AVE. W.	WASHINGTON ST	48.70	32.63	25	8.25	40.88
24	SIXTH AVE. W.	SEVENTH ST.	46.10	30.89	12	3.96	34.85
25	FIRST AVE. W.	CENTER ST.	48.20	32.29	-8	-2.64	29.65
	AVERAGE VALUES :		57.39	38.45	43.36	14.31	52.76
	STANDARD DEVIATIONS :		5.13	3.44	26.06	8.60	10.48

PRIORITY INDEX = (HAZARD INDEX x 0.67) + (BENEFIT/COST INDEX x 0.33)

IMPLEMENTATION

Within Table 13, the priority lists have been arranged in a manner in which budget considerations can readily be applied in the decision to proceed with improvements. Priority ranking was the major consideration in selecting which sites will be receiving funds first. Since limited funds are available, it is usually necessary to skip over a few higher priority projects to improve a greater number of sites as soon as possible. The listing assumes that eligible project costs will be funded by MDoT Off-system Safety funds. In the past MDoT project funding limit was less than $10,000 per project period, or else formal bid letting procedures were required by MDoT. This dollar figure was used as the criteria to define construction groupings. At this time, MDoT is in the process of deciding how these project will be funded, designed and constructed in the future. In this case, it would be futile to attempt scheduling of individual projects until new policies have been set.

There is no timetable given for these improvements and it may be conceivable that MDoT could fund most of the sites in a single years period, depending on available funding. The city will want to request funding from MDoT by submitting this report to Dave Johnson, P.E., Preconstruction Engineer.

TABLE 13. PROJECT IMPLEMENTATION COST SCHEDULE

PRIORITY NO.	AVENUE		COST ESTIMATE	MDoT ELIGIBLE FUNDS	CITY FUNDS	
1	SIXTH AVE. W.	THIRD ST.	$825	$675	$150	
2	THIRD AVE. W.	THIRD ST.	$840	$690	$150	
3	THIRD AVE. W.	EIGHTH ST.	$470	$320	$150	
4	SECOND AVE. W.	EIGHTH ST.	$825	$705	$120	
5	FIRST AVE. W.	ELEVENTH ST.	$3,515	$3,425	$90	
6	FIFTH AVE. E.	THIRD ST.	$1,260	$1,090	$170	
7	MERIDIAN ROAD	BUTTREY'S ACCESS	$14,110	$2,710	$11,400	*
8	FIRST AVE. W.	MONTANA ST.	$4,904	$1,659	$3,245	
9	SECOND AVE. W.	MONTANA ST.	$565	$465	$100	
10	SECOND AVE. W.	FIFTH ST.	$825	$705	$120	
11	SECOND AVE. W.	FIRST ST.	$1,805	$1,745	$60	
12	SIXTH AVE. W.	FIFTH ST.	$1,030	$830	$200	
13	THIRD AVE. W.	FIFTH ST.	$3,540	$2,145	$1,395	
14	FOURTH AVE. W.	FIRST ST.	$4,000	$1,090	$2,910	
15	SECOND AVE. W.	SECOND ST.	$2,185	$1,895	$290	
16	FIRST AVE. W.	TWELFTH ST.	$3,095	$2,945	$150	
17	SECOND AVE. W.	THIRD ST.	$5,307	$2,007	$3,300	
18	FIFTH AVE. W.	MONTANA ST.	$4,494	$4,194	$300	
19	FOURTH AVE. W.	CENTER ST.	$9,809	$2,309	$7,500	*
20	WOODLAND DRIVE	SECOND ST.	$86,492	$7,582	$78,910	
21	FIRST AVE. E.	MONTANA ST.	$950	$860	$90	
22	MERIDIAN ROAD	TWO MILE ROAD	$80,986	$5,826	$75,160	
23	FIRST AVE. W.	WASHINGTON ST.	$825	$725	$100	
24	SIXTH AVE. W.	SEVENTH ST.	$1,695	$1,445	$250	
25	FIRST AVE. W.	CENTER ST.	$44,542	$6,787	$37,755	*
TOTAL CONSTRUCTION COSTS =			$278,894	$54,829	$224,065	

** Property owner to make major contribution.*

STREET CORRIDORS

As previously mentioned, several street corridors have consecutive accident cluster areas which would appear to be corridor related. The following are narrative descriptions and general recommendations for improving traffic safety in these areas. None of the costs for implementing these recommendations have been included other than at those intersections already included in the specific study site improvements. Implementing corridor recommendations may be considered at locations where city forces could easily install traffic control devices. Some of the other corridor improvements may require specific study and design projects prior to implementation. These corridors may also be included in future projects and included in the transportation plan.

Meridian Road - is a north-south street which provides continuity through Kalispell, skirts the western edge of the original townsite, functions as an arterial and could be considered as an alternative alignment for portions of a beltloop or by-pass route. Whatever the outcome of the transportation plan, it's location is strategic in terms of system traffic flow. Because of methods used in this study, not all of the accidents along Meridian Road are detailed, but it is estimated that at least 100 accidents occurred in a four year period between the Buttreys' approach on the south to Three Mile Road on the north. Traffic control on this street varies along its length, however most of the roadway section provides three lanes of traffic. Traffic volumes are increasing at a rate of approximately 3% per year. New construction of a major postal facility north of Idaho Street is in progress, which provides ample evidence that traffic volumes are not going to level off. Existing traffic volumes are very near the design capacity of a three lane street. As volumes increase and the level-of-service drops, Meridian Road will probably witness significant increases in the number of accidents.

Because of the present roadway geometry little can be done to improve the safety of this corridor without major reconstruction. The Two Mile Road intersection improvements include a traffic signal and some approach widening. This will certainly improve the safety at this location, but the remainder of Meridian cannot be affect-

ed by this project. Relocation of the Buttreys' approach will reduce conflicts south of Idaho Street only at the approach. The remaining roadway remains exposed to increasing traffic volumes with inadequate facilities to handle it safely and efficiently. Long term corridor improvements, including reconstruction will be necessary to provide any lasting benefits. The transportation plan should address these needs.

Relative to funding; this is one location where the City of Kalispell should have had the proper ordinances on the books which would have preserved the safety and efficiency of the public streets by requiring developers to provide a traffic accessibility study to identify traffic impacts. The developers would then either pay impact assessments or construct the necessary facilities to handle the traffic that their developments would generate.

Montana Street - between Main and Fifth Avenue West, is parallel to Idaho Street and carries circulation traffic from businesses fronting on Idaho as well traffic trying to avoid the long signal delays at Main and Idaho. The intersections on this section of Montana were all uncontrolled at one time. The intersection of Montana and Second Avenue West had stop signs installed in 1991 which virtually eliminate all accidents at that site. Other intersections on Montana are very similar and should receive similar control, as discussed in the site specific sections of this report. Montana should be marked as a through street along this corridor until such time that other system improvements could reduce traffic demands on this street.

First Avenue West - from Center Street to Twelfth Street, runs parallel to Main Street and carries a significant amount of Main Street spill-over traffic, in addition to downtown circulation traffic. There were a minimum of 157 accidents on this corridor during the four year reporting period. Most of the accidents were within the downtown corridor. Intersections on the south end of the First Avenue corridor are in a residential area. The only common relationship between the accidents at various intersections is the fact that First Avenue carries significantly more traffic than intersecting side streets and at higher speeds. First Avenue West is a two lane two-way street with parking on both sides and it is apparent that corner parking restrictions are not entirely compatible with the volumes and speeds encountered. In order to alleviate limited sight distances along First, it is recommended that corner

parking restrictions be increased to a length compatible with each individual intersection's geometry and sight requirements. These restrictions would range between 50 and 70 feet. As traffic volumes increase in the future beyond 6,000 ADT, it would be recommended that First Avenue be changed to a three lane street incorporating a continuous two way left turn lane in the middle. This would improve the level-of-service greatly and increase safety by eliminating parking throughout the majority of the corridor.

Other future improvements that may be considered as part of the transportation plan would be the concept of providing a better connection to US 93 at the south end of the corridor. This connection could be made at the same location as the First Avenue East - US 93 intersection. Many variations of traffic control and routing along this corridor could be possible and should be investigated.

Downtown Streets, - especially within the central business district, have accident clusters at every intersection. While some of the accident rates are not extremely high, there should be some concern over the high concentrations of accidents. The downtown area is composed of many and varied traffic control features. Lack of consistency seems to be one of the problems. Also, left turn prohibitions on Main Street serves to increase side street circulation way beyond actual travel demand on these streets. Basically, these two factors create many conflicts which ultimately result in accidents. Some improvements could be made which would provide more uniform traffic control strategies, but the ultimate solution lies with the disposition of Main Street and the long range transportation plan.

Kalispell High School Area Streets - involve a cluster of accidents at intersections immediately adjacent to the high school and within a three block area north and east of the high school. This situation is not unique in Montana since accident clusters can be found near any high school within the state of Montana. However, this situation is much more drastic, since it includes eleven intersections where most similar situations would only include one or two intersections. The apparent reason for this problem would be the lack of clearly defined collector or arterial streets leading to and from the high school. The Sixth and Seventh Street one-way couplet was apparently an attempt at providing access for the high peak hour traffic

associated with high schools, but this solution only serves easterly access demands.

In addition to high peak hour volumes accessing the high school, parking facilities at the high school are inadequate. Therefore, students park on narrow residential streets which surround the school. The parked vehicles significantly affect the accident problem because of potential sight obstructions at the intersections.

Short term solutions to this problem would be marking of increased parking restrictions at intersections within three to four blocks of the high school and investigating the need for additional traffic control devices at these intersections. The ultimate solution would require construction of adequate off street parking facilities and designation of thru routes along with improved traffic facilities to and from the school area. This would require a detailed planning study with full cooperation of school officials.

PROGRAM CONTINUATION

Since the basic format of the study has been outlined and an initial priority list established, continuance of this program or a similar program is strongly advised. The findings and recommendations of this study will soon become obsolete without continued updating at least on an annual basis. The following recommendations for continuance of the program are offered to the City of Kalispell:

1. The City should determine the proper departmental responsibility for performing work and administering the program. That department should receive Police accident reports and process the information necessary for adequate data files.

2. One person should be assessed with the responsibility of the program to insure that all data is being supplied and processed.

3. Computer files should be modified to enable access to reports by exact location. Cluster site information should be extracted and stored on a separate program as they are received.

4. Criteria should be developed for the inclusion of additional sites to be analyzed, such as number of accidents, accident rate and severity.

5. Coordinate existing traffic counting programs to include areas that may not currently be covered. With broad enough coverage, estimates of volumes on all street segments can be made for screening purposes.

6. Analyze new sites according to all or selected procedures of this study and include them in the priority list when warranted.

All of the data processing and storage can be handled by most computer spreadsheet software programs. A copy of the data disk has been provided to the City of Kalispell. If translation problems occur between these data files and the City's spread sheet program, they can be translated to a ASCII file upon request.

REPORT

FIGURES

HAZARD

INDICATOR

VALUES

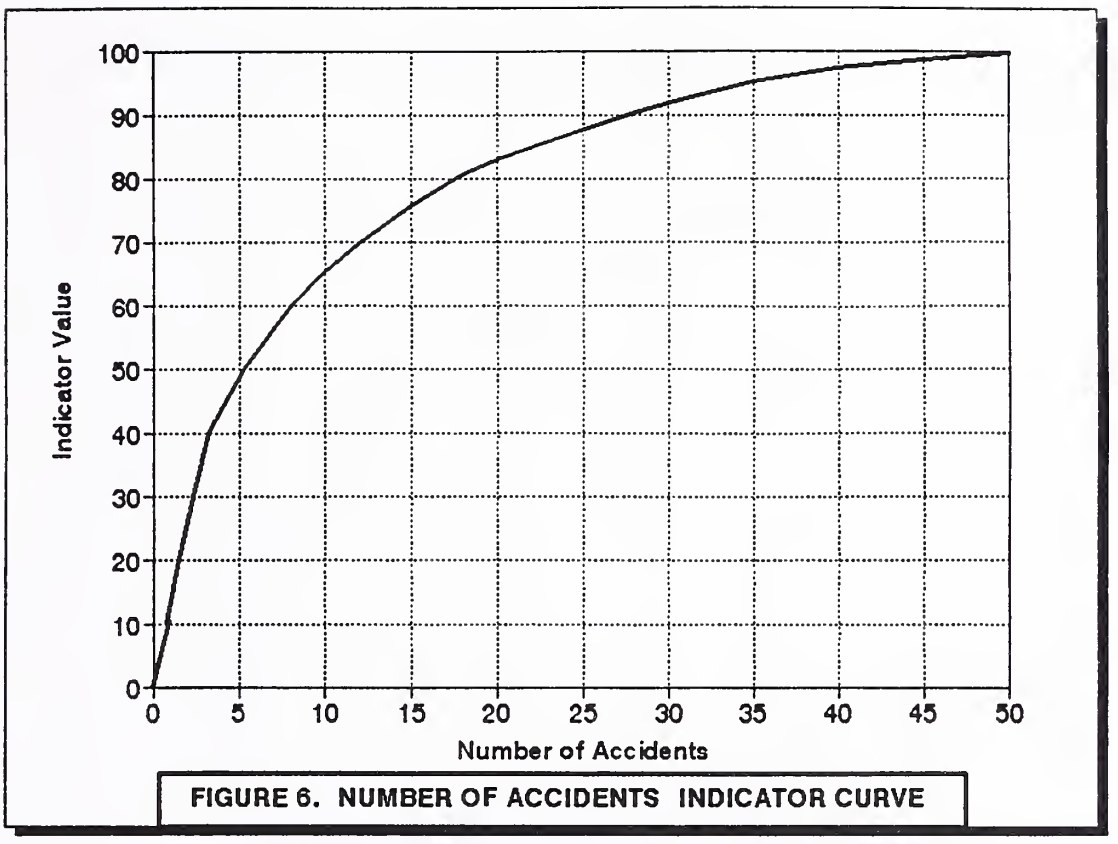


FIGURE 6. NUMBER OF ACCIDENTS INDICATOR CURVE

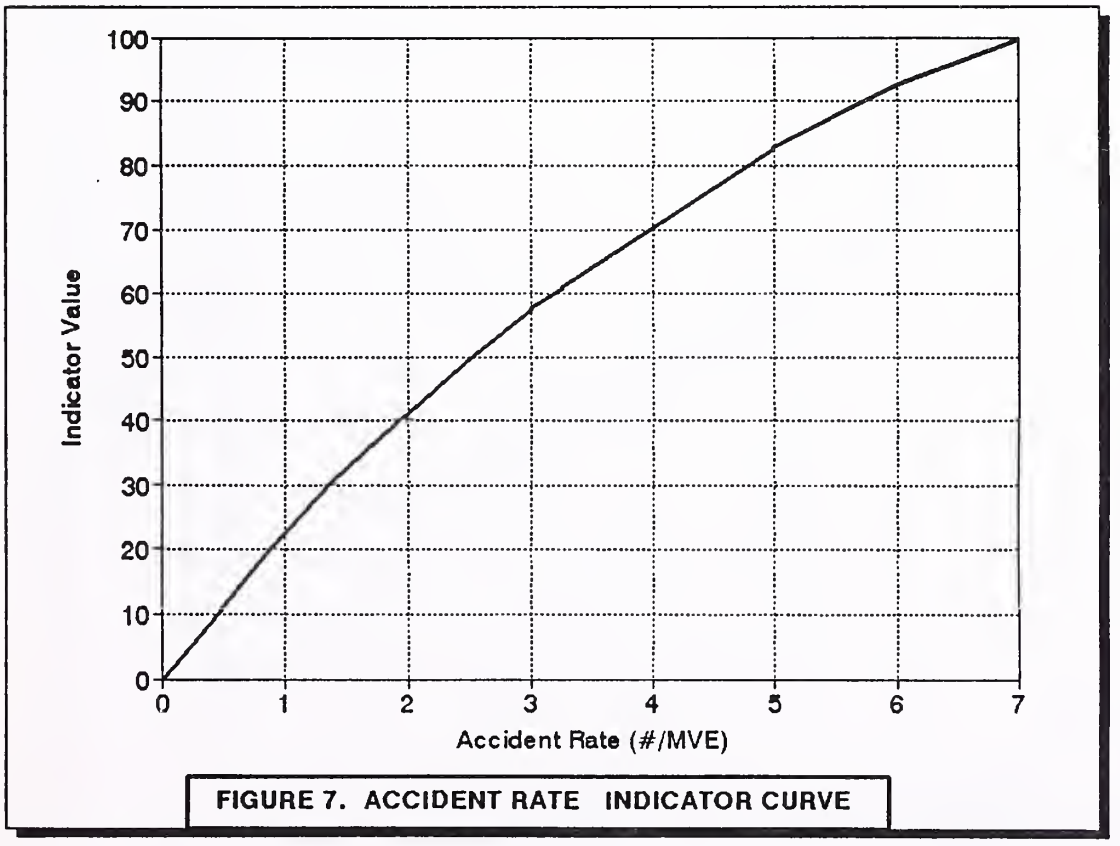


FIGURE 7. ACCIDENT RATE INDICATOR CURVE

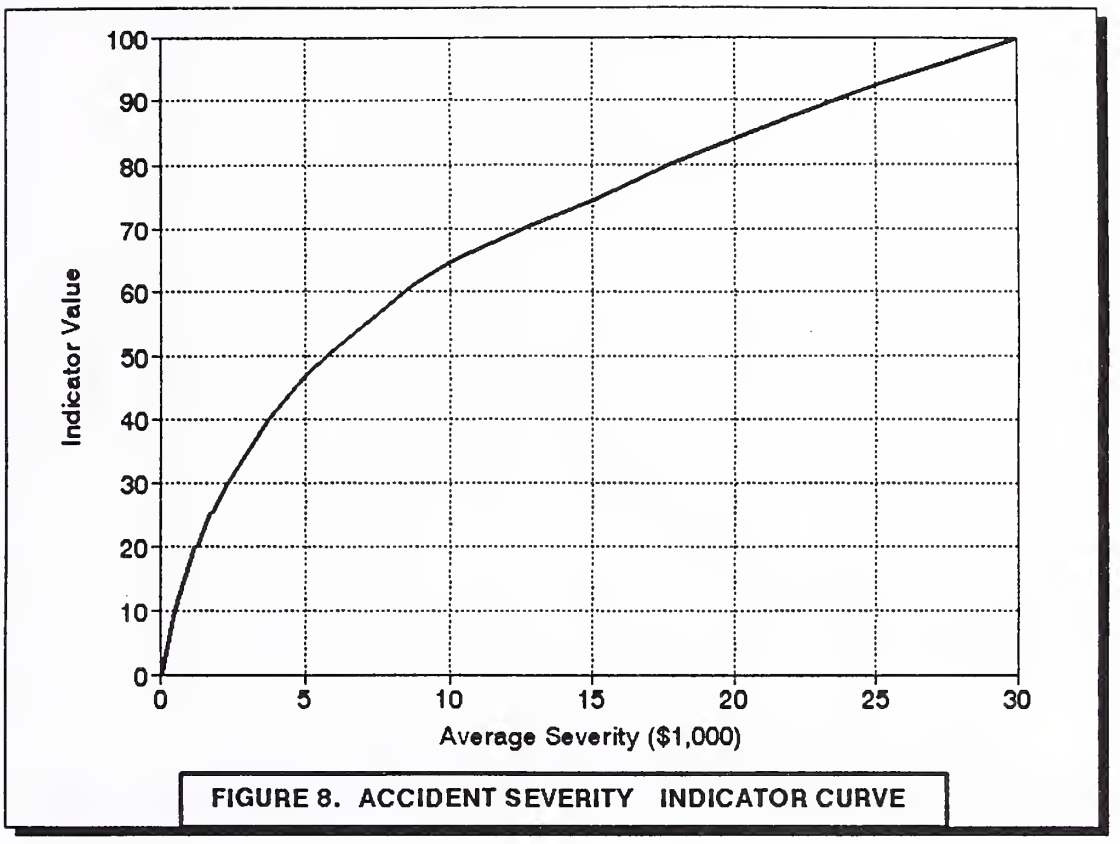


FIGURE 8. ACCIDENT SEVERITY INDICATOR CURVE

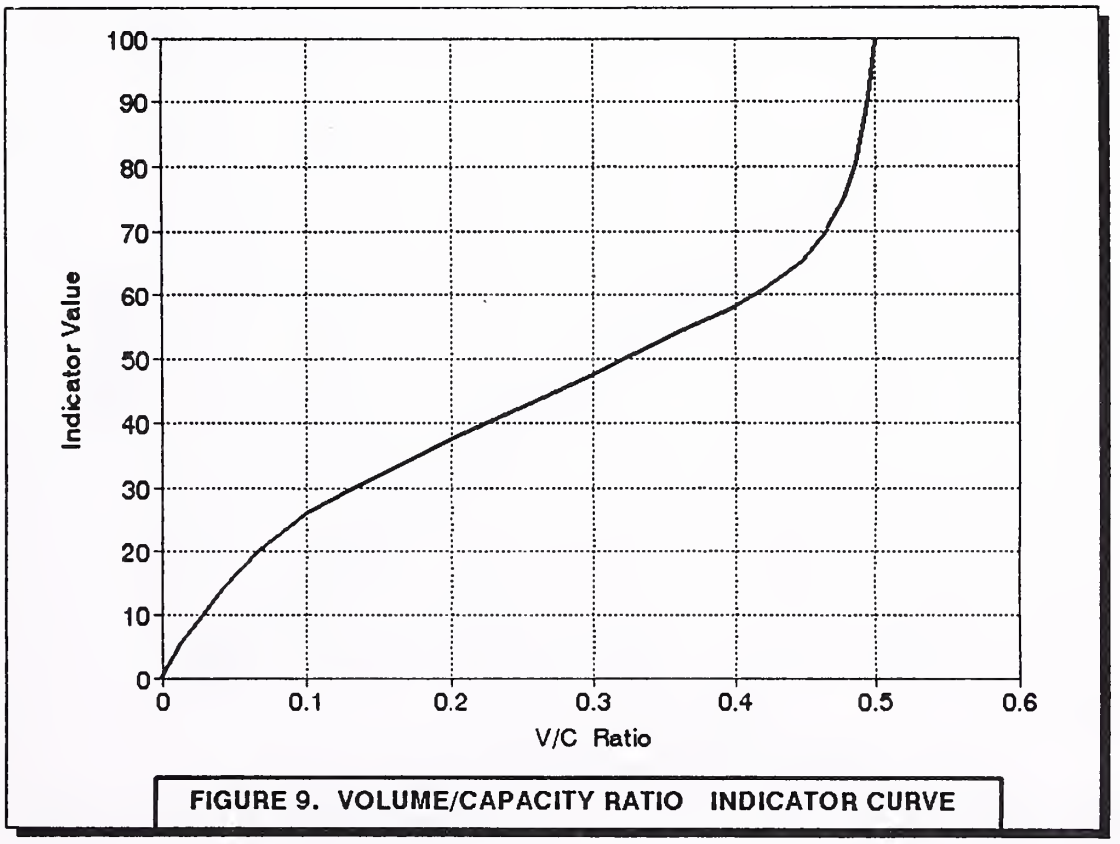


FIGURE 9. VOLUME/CAPACITY RATIO INDICATOR CURVE

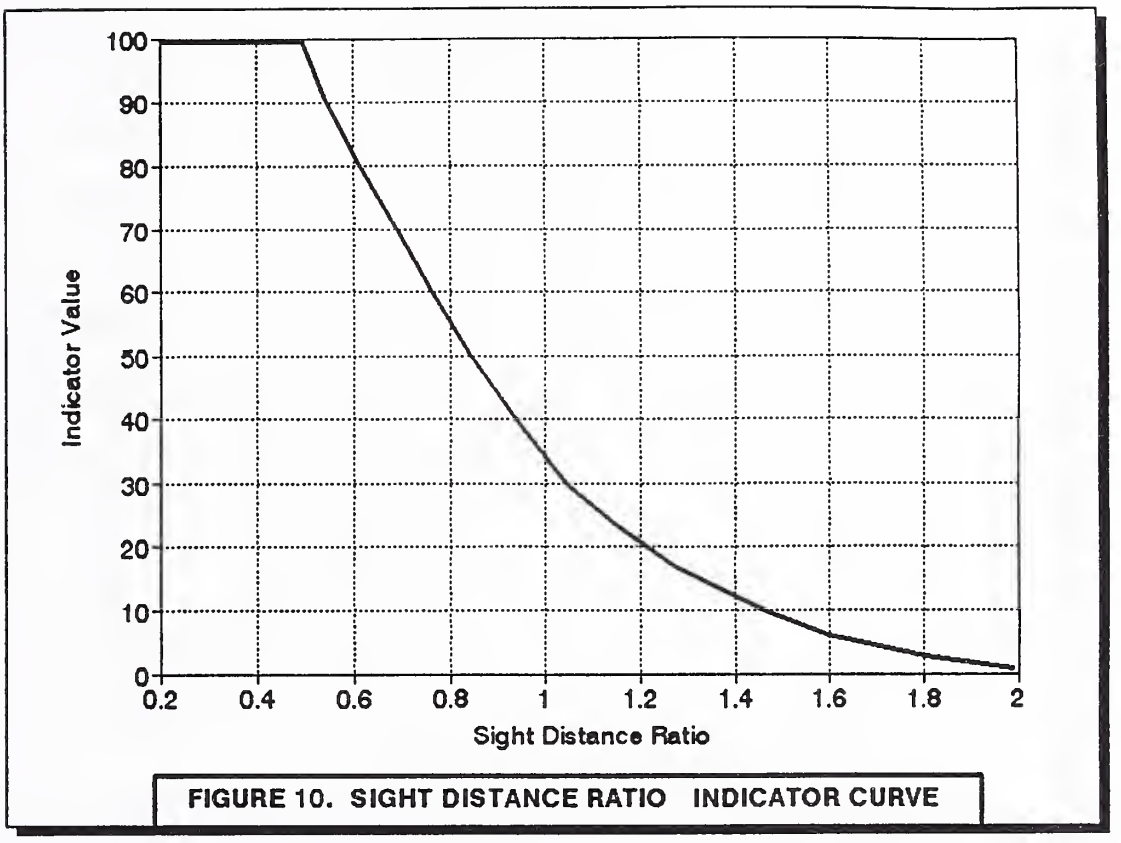


FIGURE 10. SIGHT DISTANCE RATIO INDICATOR CURVE

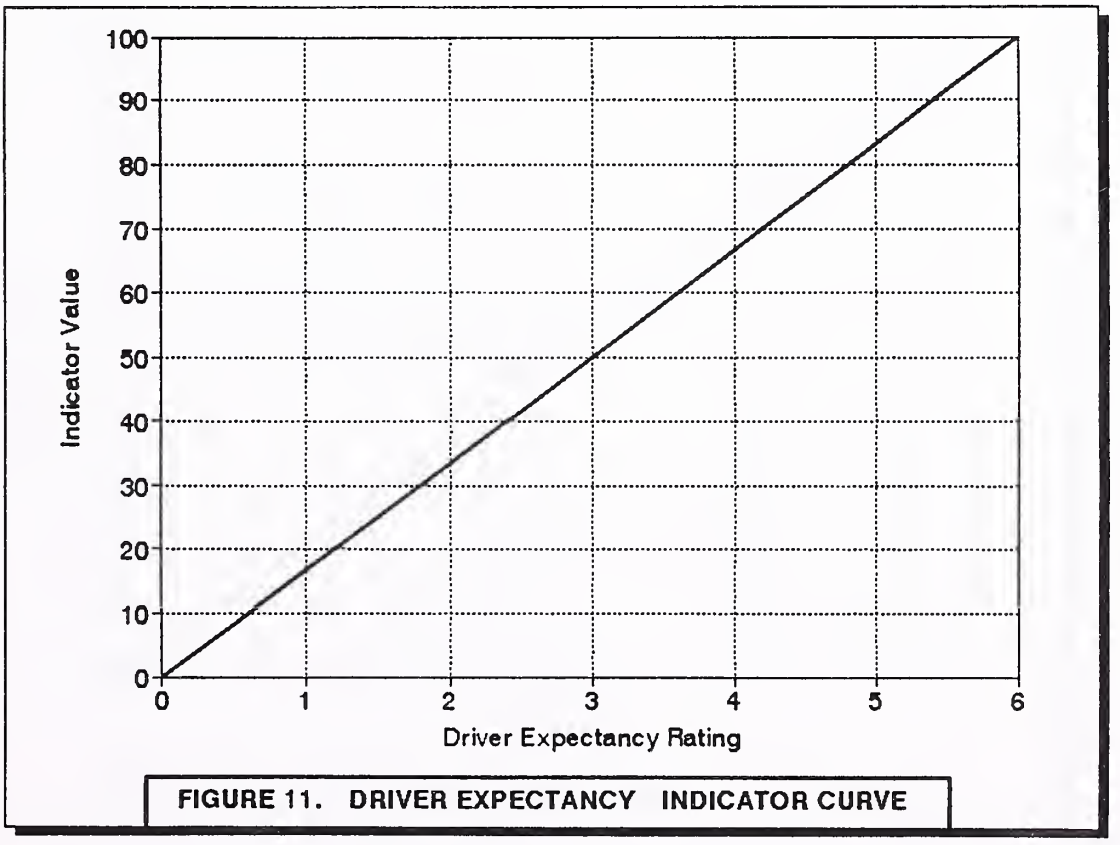


FIGURE 11. DRIVER EXPECTANCY INDICATOR CURVE

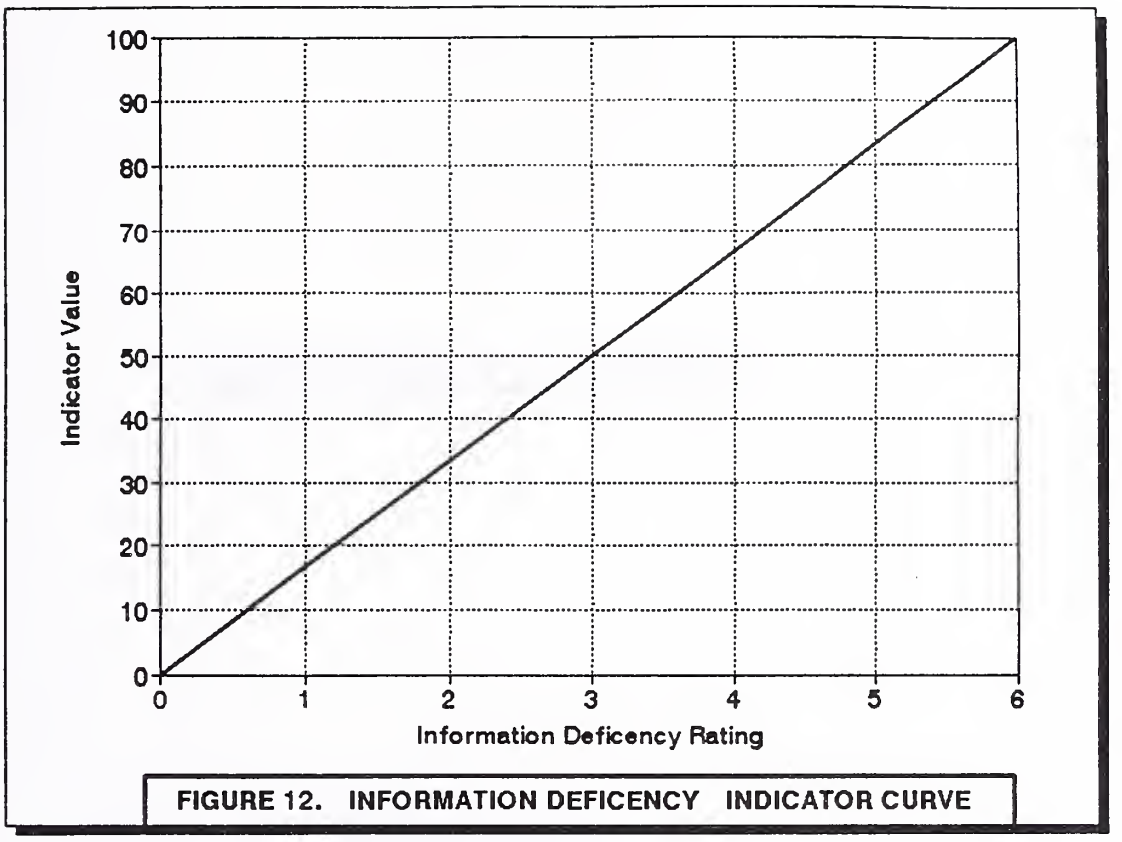


FIGURE 12. INFORMATION DEFICENCY INDICATOR CURVE

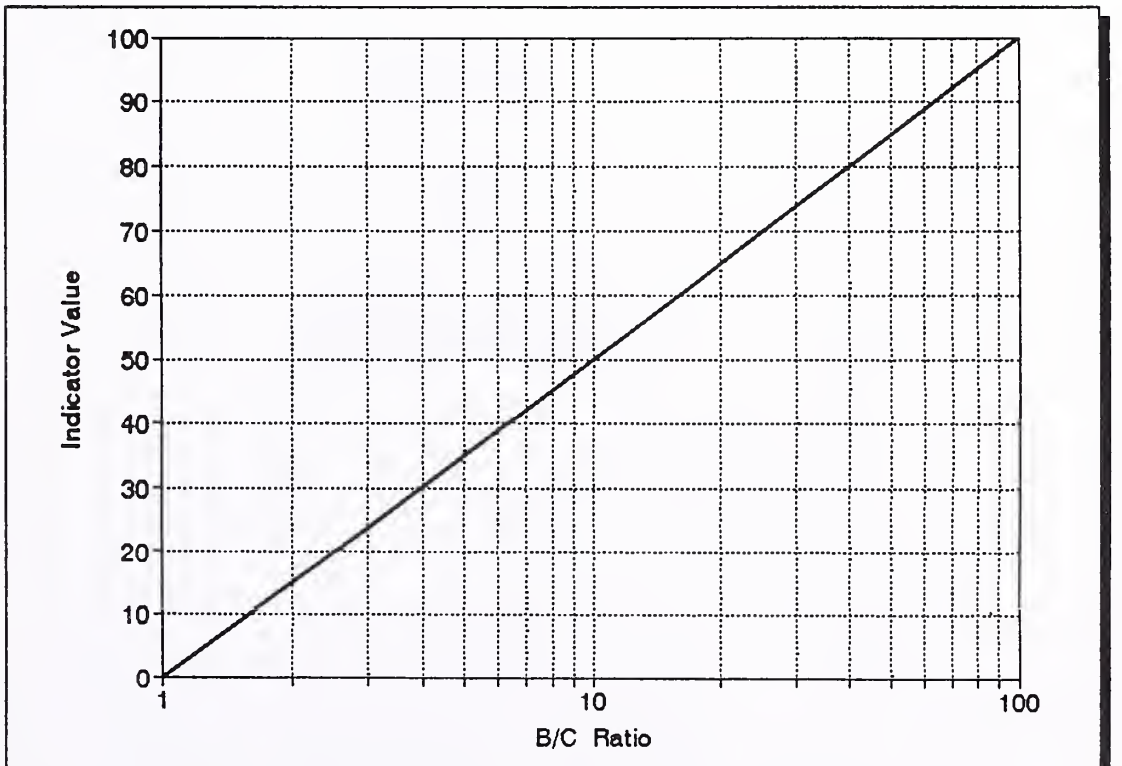


FIGURE 13. BENEFIT/COST RATIO INDICATOR CURVE

INDIVIDUAL SITES

SPECIFIC

DATA

&

ANALYSIS

SITE

NUMBER

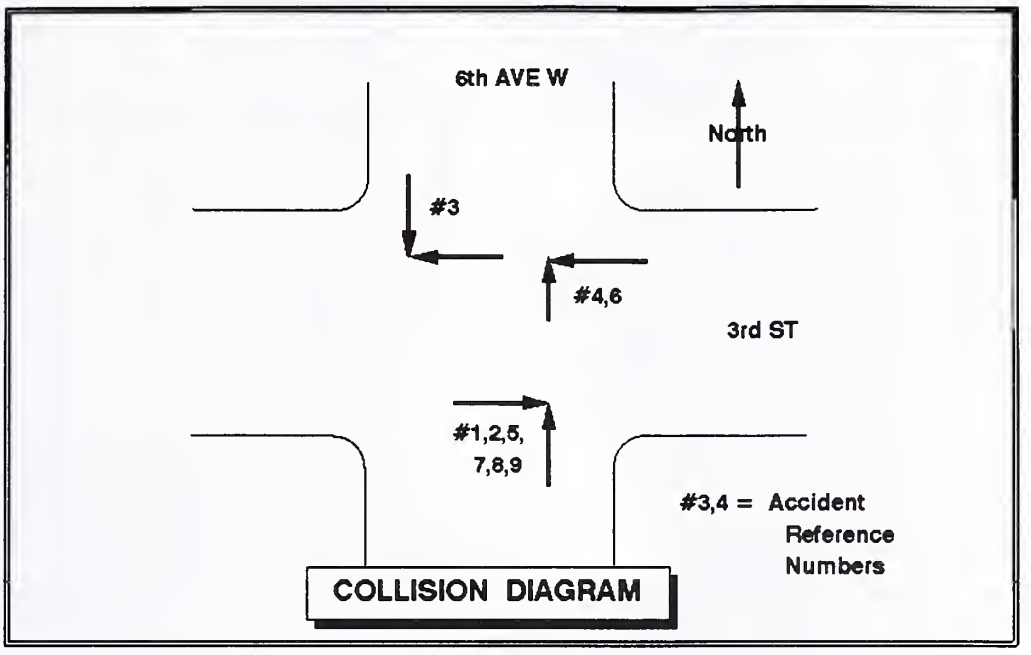
1

SIXTH AVENUE WEST

and

THIRD STREET

ACCIDENT SUMMARY
SIXTH AVE. W & THIRD ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	1	26	88	1425	INJURY	CLEAR	SNOW	DAY
2	ANGLE	7	18	88	1656	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	11	15	88	804	INJURY	CLEAR	DRY	DAY
4	ANGLE	6	28	89	1456	INJURY	CLEAR	DRY	DAY
5	ANGLE	2	9	90	1253	PROP DAM	SNOW	SNOW	DAY
6	ANGLE	10	14	90	1521	PROP DAM	CLEAR	DRY	DAY
7	ANGLE	1	30	91	1530	INJURY	CLEAR	ICY	DAY
8	ANGLE	4	15	91	820	INJURY	CLEAR	DRY	DAY
9	ANGLE	6	22	91	1325	INJURY	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
3	1988	#INJ ACC	6	
1	1989	#FAT ACC	0	
2	1990	#PDO ACC	3	
3	1991	PERSON =	10	*
9	TOTAL	NIGHTIME	0%	

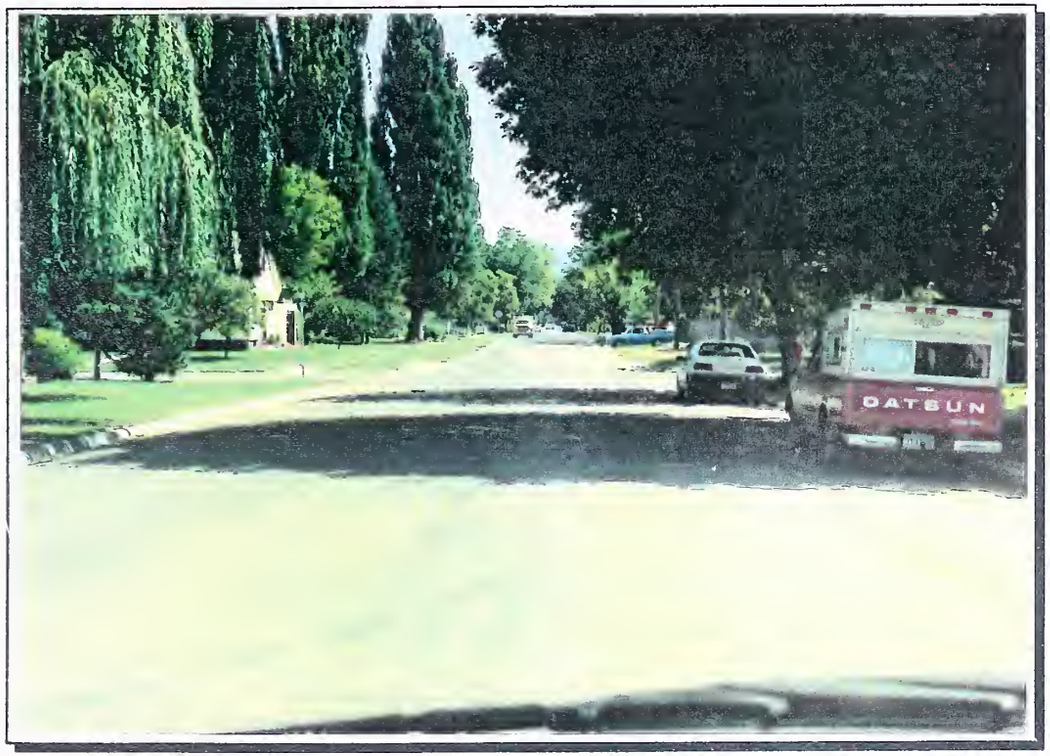
TYPES	NUMBER	ROAD	
ANGLE	9	DRY	67%
REAR END	0	WET	0%
SIDESWIPE	0	SNOW	22%
LEFT TRN	0	ICE	11%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

SIXTH AVENUE WEST

Looking South



Looking East

THIRD STREET

Looking West

TRAFFIC OPERATIONS

Third Street is a local east-west street and Sixth Avenue West is a local north-south street. Their intersection is in the middle of a well kept residential area of Kalispell. The intersection appears to be typical of other intersections in the area. Both streets have tree lined boulevards with large deciduous trees. Parking is allowed on both sides of the street. Traffic volumes on Sixth are very low, while Third Street has about double the volume at 500 vehicles per day.

There are low growing trees, bushes and fences within the corner sight triangle. Sight distance is especially bad in the southeast and southwest corners. Narrow street right-of-way and inadequate building setbacks at this intersection are slightly better than many intersections in this area. Street surface are smooth and uniform. On-street parking appears to be moderate on the approach streets.

The required sight distance for an uncontrolled intersection and 25 mph vehicle operating speeds is 110 feet. It was determined that a house in two corners of this intersection encroach upon the sight triangle required for an uncontrolled intersection. While it was difficult to determine definite traffic operational characteristics at this site because of the low traffic volumes, it was noted that east-west traffic was the most reluctant to change speed on the approach to the intersection. In addition, a high percentage of the drivers in the east-west directions failed to even look for side street traffic.

There were 9 angle accidents reported during the four year period that this study encompassed. All but one of the accidents involved northbound vehicles. Road conditions were not too significant since 67% of the accidents occurred on a dry street surface. There were no night time accidents. Accident severity at this intersection was extremely high with 10 injuries resulting from 9 accidents.

IMPROVEMENTS

Since permanent sight restrictions exist in all corners of this intersection and there is sufficient evidence that it cannot function reasonably well as an uncontrolled intersection, vehicle right-of-way control is indicated. Yield signs

cannot be used because yield signs require the same unobtrusive line of sight that is necessary for uncontrolled intersections. Therefore, stop sign control is recommended for the lesser volume, Sixth Avenue West. There are stop signs at the intersections both north and south of this location and from observations, it appears that vehicles expect to slow or stop in the north and south directions.

Yellow curbs should be painted in the intersection area to reduce the possibility of vehicles parking too close to the intersection. Trees on the approach to the new stop sign installation should be trimmed to provide an unimpeded view of the stop signs. Because of missing curb sections and the need to restrict parking even when the curb may be obscured, parking signs should also be installed.

Long term improvements do not appear to be applicable to the conditions encountered at this site.

SIXTH AVE. W & THIRD ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	300
SOUTH APP	300
EAST APP	500
WEST APP	500

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$825
MDoT FUND	$675
CITY FUND	$150

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	3.6	60%
PDO	1.8	60%

BENEFIT/COST RATIO: 99

	INDEX VALUE	SITE RANK
# ACCIDENTS	64	14
ACCIDENT RATE	100	2
SEVERITY	71	1
VOL/CAPACITY	9	23
SIGHT DIST.	59	19
DRIVER EXPECT	58	14
INFO DEFICIENT	58	17
HAZARD INDEX	66.7	1
B/C RATIO	100	1

PRIORITY	77.7	1

SITE

NUMBER

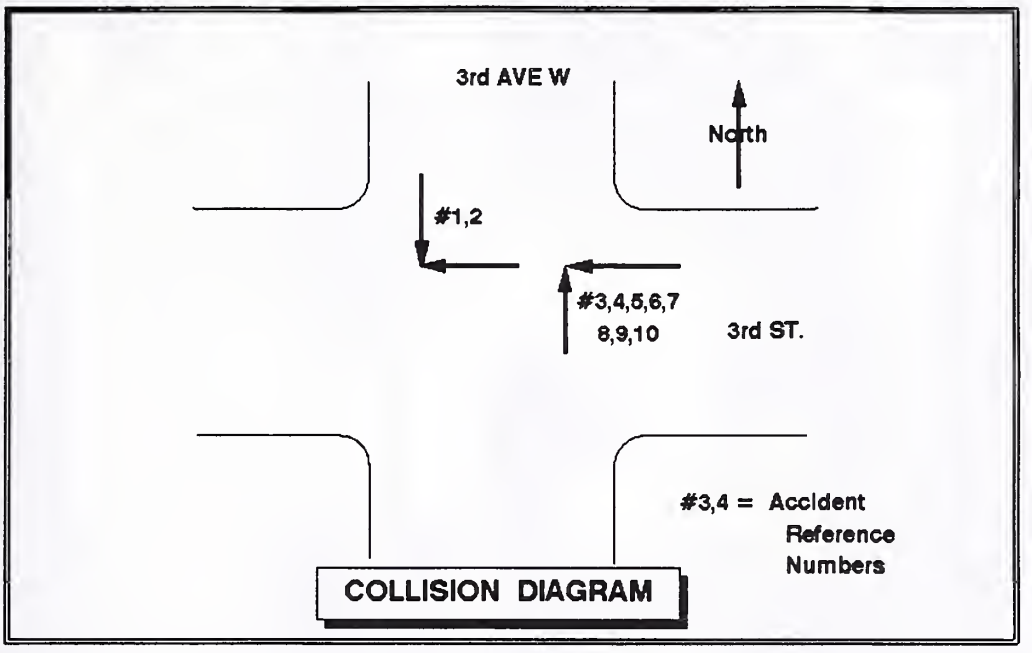
2

THIRD AVENUE WEST

and

THIRD STREET

ACCIDENT SUMMARY
THIRD AVE. W & THIRD ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	1	6	88	818	INJURY	SNOW	ICY	DAY
2	ANGLE	2	24	88	810	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	7	29	88	1024	PROP DAM	CLEAR	DRY	DAY
4	ANGLE	12	16	88	1539	PROP DAM	CLEAR	ICY	DAY
5	ANGLE	1	27	89	1103	PROP DAM	CLEAR	ICY	DAY
6	ANGLE	1	31	89	1216	PROP DAM	CLEAR	ICY	DAY
7	ANGLE	8	24	89	1648	PROP DAM	RAIN	WET	DAY
8	ANGLE	1	28	91	1605	PROP DAM	CLEAR	ICY	DAY
9	ANGLE	4	23	91	2009	PROP DAM	CLEAR	DRY	DAY
10	ANGLE	11	5	91	1525	INJURY	RAIN	WET	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
4	1988	#INJ ACC	2	
3	1989	#FAT ACC	0	
0	1990	#PDO ACC	8	
3	1991	PERSON =	3	*
10	TOTAL	NIGHTIME	0%	

TYPES	NUMBER	ROAD	
ANGLE	10	DRY	30%
REAR END	0	WET	20%
SIDESWIPE	0	SNOW	0%
LEFT TRN	0	ICE	50%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

THIRD AVENUE WEST

Looking South

Looking East

THIRD STREET

Looking West

TRAFFIC OPERATIONS

Third Street is a local east-west street and Third Avenue West is a local north-south street. Their intersection is in the middle residential area on the fringe of the Central Business District in Kalispell. There has been some construction in this area in the recent past. There are newer curb and gutter sections, sidewalk and drive approaches. There are newer apartment buildings on three of the four corners. Both streets have tree lined boulevards with large deciduous trees. Parking is allowed on both sides of the street and demand for parking appears to be moderate to high. Traffic volumes on Third Avenue are very low, while Third Street has about double the volume at 1300 vehicles per day.

Sight distance is especially bad in the southwest corner. Narrow street right-of-way and inadequate building setbacks at this intersection cause intrusion of permanent obstructions within the sight triangle required for uncontrolled intersections. Large tree trunks also cause a temporary loss of sight distance which can sometimes be more troublesome than larger, more imposing obstructions. Street surface are smooth and uniform.

It was noted that east-west traffic was the most reluctant to change speed on the approach to the intersection, especially in the eastbound direction. Since this intersection is on the fringe of the CBD, drivers are more likely to assume that they are on a thru street when entering and leaving the downtown area. East-west vehicles also travel at a higher rate of speed than do north-south vehicles.

There were 10 angle accidents reported during the four year period that this study encompassed. All but one of the accidents involved northbound and westbound vehicles. Road conditions were significant at this site since 70% of the accidents occurred on a snowy or icy street surfaces. There were no night time accidents. Most of the accidents occurred between the hours of 10 AM and 4 PM.

IMPROVEMENTS

Since permanent sight restrictions exist in all corners of this intersection and there is sufficient evidence that it cannot function reasonably well as an uncontrolled intersection, vehicle right-of-way control is indicated. Yield signs

cannot be used because yield signs require the same unobtrusive line of sight that is necessary for uncontrolled intersections. Therefore, stop sign control is recommended for the lesser volume, Third Avenue West. There are stop signs at the intersections both north and south of this location and from observations, it appears that vehicles expect to slow or stop in the north and south directions.

The accident pattern at this intersection appears to be a classic case of the "Misdirected Attention Syndrome". MAS occurs whenever there is a defect in the roadway or roadside which is obvious to the majority of drivers. Their attention becomes focused on that defect while becoming oblivious to other clear and present dangers. In this case, the large building, trees and parked cars in the southwest corner of this intersection is an obvious sight obstruction which drivers focus upon when approaching from the south. While trying to see eastbound vehicles, drivers tend to ignore vehicles in the higher volume westbound approach. By the time they have satisfied their urge to focus on that single conflict, it is too late to react to a westbound vehicle entering the intersection. The stop signs should eliminate this problem since there would be a clear line of sight in both directions from the stopped position, when adequate parking restrictions are implemented.

Yellow curbs should be painted in the intersection area to reduce the possibility of vehicles parking too close to the intersection. Trees on the approach to the new stop sign installation should be trimmed to provide an unimpeded view of the stop signs. Because of moderate to high parking demand in the area and the need to restrict parking even when the curb may be obscured by snow or leaves, parking signs should also be installed.

Long term improvements do not appear to be applicable to the conditions encountered at this site.

THIRD AVE. W & THIRD ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	550
SOUTH APP	550
EAST APP	1300
WEST APP	1200

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$840
MDoT FUND	$690
CITY FUND	$150

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	1.2	60%
PDO	4.8	60%

BENEFIT/COST RATIO: 37

	INDEX VALUE	SITE RANK
# ACCIDENTS	67	10
ACCIDENT RATE	68	7
SEVERITY	49	10
VOL/CAPACITY	19	16
SIGHT DIST.	100	13
DRIVER EXPECT	58	13
INFO DEFICIENT	58	22
HAZARD INDEX	59.7	10
B/C RATIO	79	3

PRIORITY	66.07	2

SITE

NUMBER

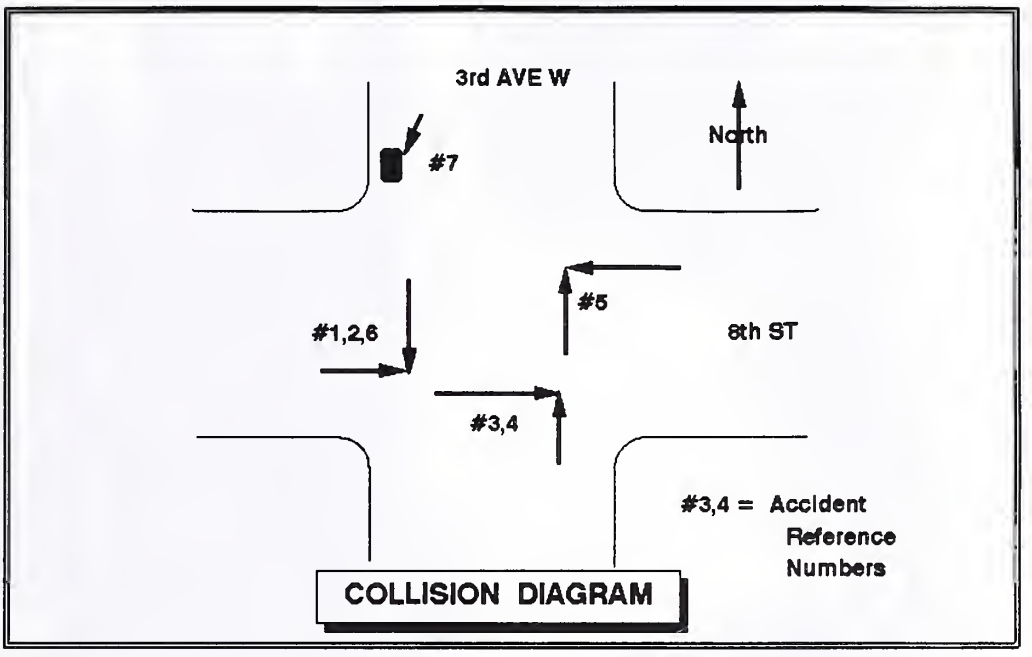
3

THIRD AVENUE WEST

and

EIGHTH STREET

ACCIDENT SUMMARY
THIRD AVE. W & EIGHTH ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	10	14	88	2125	PROP DAM	RAIN	WET	NITE
2	ANGLE	5	2	89	1524	PROP DAM	RAIN	WET	DAY
3	ANGLE	1	20	90	1057	PROP DAM	CLEAR	DRY	DAY
4	ANGLE	5	11	90	1216	INJURY	CLEAR	DRY	DAY
5	ANGLE	10	24	90	1752	INJURY	CLEAR	DRY	DAY
6	ANGLE	2	1	91	1756	PROP DAM	CLEAR	ICY	NITE
7	PARKED VEH	9	19	90	1530	PROP DAM	CLEAR	DRY	DAY

ACCIDENT STATISTICS

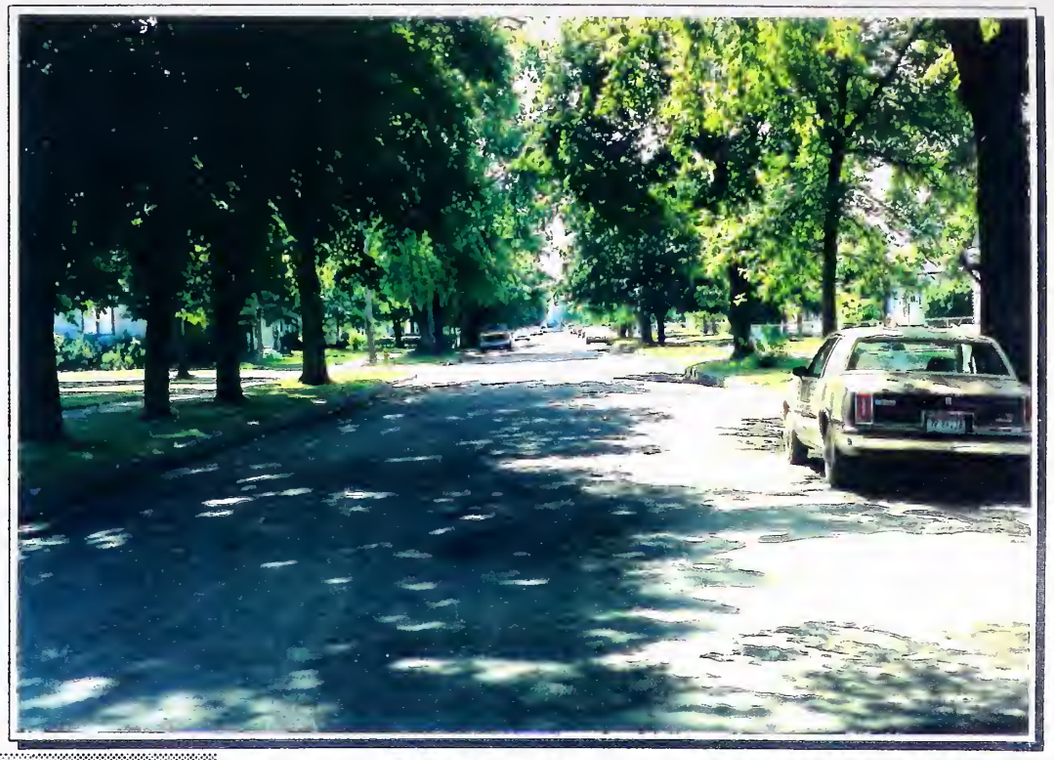
NO. ACC.	YEAR			
1	1988	#INJ ACC	2	
1	1989	#FAT ACC	0	
4	1990	#PDO ACC	5	
1	1991	PERSON =	2	*
7	TOTAL	NIGHTIME	29%	

TYPES	NUMBER	ROAD	
ANGLE	6	DRY	57%
REAR END	0	WET	29%
SIDESWIPE	0	SNOW	0%
LEFT TRN	0	ICE	14%
OTHER	1	OTHER	0%

*** No. of Persons Injured**

Looking North

THIRD AVENUE WEST



Looking South

Looking East

EIGHTH STREET

Looking West

TRAFFIC OPERATIONS

Eighth Street is a local east-west street and Third Avenue West is a local north-south street. Their intersection is in the middle of a residential area just south and east of Kalispell High School. Another study site is located one block to the east on Eighth at Second Avenue West. Both intersections are heavily influenced by high school traffic and parking. Both streets have tree lined boulevards with large deciduous trees. Parking is allowed on both sides of the street and demand for parking appears to be extremely high when school is in session. Traffic volumes on Third Avenue are very low, while Eighth Street has about double the volume at 400 vehicles per day.

Their are narrow street rights-of-way, however building setbacks at this intersection are just adequate to provide sight distance for an uncontrolled intersection. Large tree trunks do cause a temporary loss of sight distance which can sometimes be more troublesome than larger, more imposing obstructions. Street surfaces are rough.

Traffic volumes at this intersection were so low that it was difficult to determine any clearly defined operating patterns. Vehicles observed were traveling within a normal range of speeds. As with other intersections in this area of town, east-west traffic appears to have claim on thru movements.

There were 6 angle accidents reported during the four year period that this study encompassed. One other accident occurred that involved a car parked near the northwest corner. All but one of the accidents involved northbound and westbound vehicles. Road conditions were significant at this site since 43% of the accidents occurred on a snowy or icy street surfaces. There were 2 night time accidents. Most of the accidents occurred between the hours of noon and 6 PM.

IMPROVEMENTS

The apparent conditions contributing to accidents at this location are sight obstructions caused by low growing trees and parked vehicles. Since sight restrictions, which exist at this intersection, are not permanent. Numerous

trees in the area could be trimmed and this intersection could function with yield signs on the minor street, Third Avenue West. All curbs should also be painted yellow within a minimum distance of 60 feet from the corner radii to ensure sight distance is not blocked by parked vehicles.

Since yield signs only provide a limited margin of safety in some circumstances, the city may want to assess this recommendation prior to implementation. If the yield signs would be a unique situation in Kalispell, stop signs should probably be installed instead. The most important aspect of intersection control is consistency. If consistency is violated, so will driver expectancy. Stop signs would also require less removal of parking to implement.

Long term improvements do not appear to be applicable to the conditions encountered at this site.

THIRD AVE. W & EIGHTH ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	200
SOUTH APP	200
EAST APP	400
WEST APP	400

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	YES
STOP	
CURB/WALK	
MARKING	
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$470
MDoT FUND	$320
CITY FUND	$150

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	1.2	60%
PDO	2.8	51%

BENEFIT/COST RATIO: 40

	INDEX VALUE	SITE RANK
# ACCIDENTS	58	20
ACCIDENT RATE	100	1
SEVERITY	47	11
VOL/CAPACITY	7	25
SIGHT DIST.	35	25
DRIVER EXPECT	54	22
INFO DEFICIENT	58	21
HAZARD INDEX	58.6	11
B/C RATIO	80	2

PRIORITY	65.66	3

SITE

NUMBER

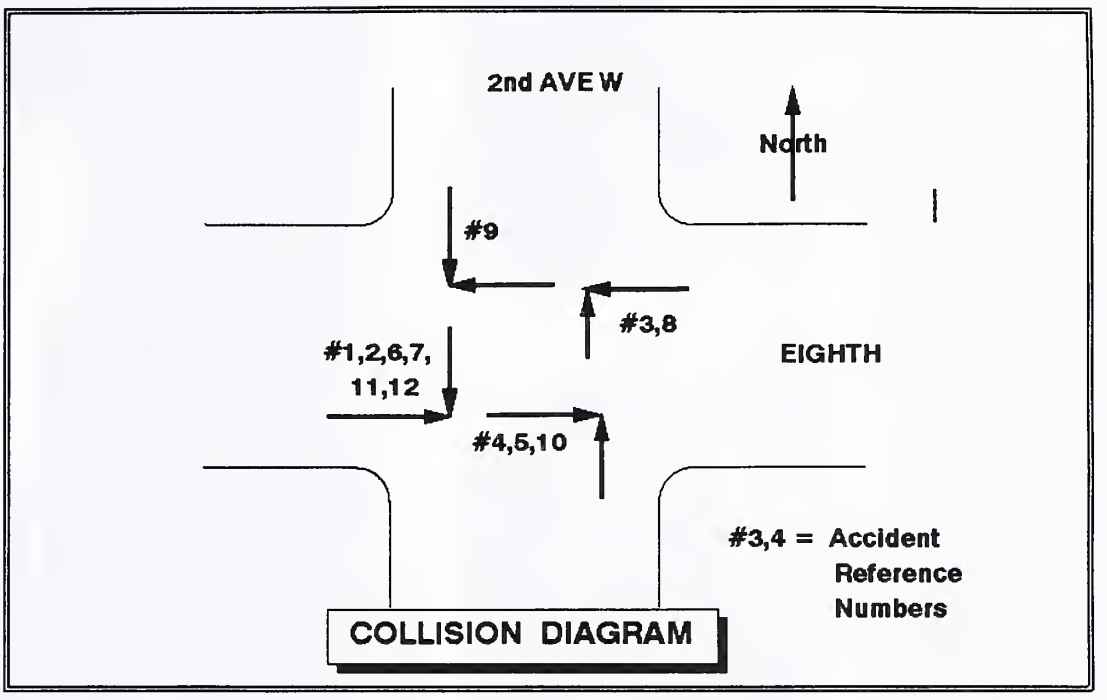
4

SECOND AVENUE WEST

and

EIGHTH STREET

ACCIDENT SUMMARY
SECOND AVE. W & EIGHTH ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	1	9	88	45	PROP DAM	SNOW	ICY	NITE
2	ANGLE	7	15	88	758	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	1	24	89	800	INJURY	CLEAR	DRY	DAY
4	ANGLE	2	27	89	935	PROP DAM	SNOW	ICY	DAY
5	ANGLE	3	13	89	927	INJURY	RAIN	WET	DAY
6	ANGLE	1	4	90	1330	PROP DAM	SNOW	ICY	DAY
7	ANGLE	4	19	90	1755	PROP DAM	CLEAR	DRY	DAY
8	ANGLE	11	13	90	1115	PROP DAM	RAIN	WET	DAY
9	ANGLE	12	30	90	1403	PROP DAM	SNOW	ICY	DAY
10	ANGLE	3	4	91	1527	INJURY	SNOW	SNOW	DAY
11	ANGLE	4	29	91	1200	PROP DAM	CLEAR	DRY	DAY
12	ANGLE	11	26	91	1355	PROP DAM	RAIN	WET	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR		
2	1988	#INJ ACC	3
3	1989	#FAT ACC	0
4	1990	#PDO ACC	9
3	1991	PERSON =	3 *
12	TOTAL	NIGHTIME	8%

TYPES	NUMBER	ROAD	
ANGLE	12	DRY	33%
REAR END	0	WET	25%
SIDESWIPE	0	SNOW	8%
LEFT TRN	0	ICE	33%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

SECOND AVENUE WEST

Looking South

Looking East

EIGHTH STREET

Looking West

TRAFFIC OPERATIONS

Eighth Street is a local east-west street and Second Avenue West is a local north-south street. Their intersection is in the middle of a residential area just south and east of Kalispell High School. Another study site is located one block to the west on Eighth at Third Avenue West. Both intersections are heavily influenced by high school traffic and parking. Both streets have tree lined boulevards with large deciduous trees. Parking is allowed on both sides of the street and demand for parking appears to be extremely high when school is in session. Traffic volumes on Second Avenue are low, while Eighth Street has about double the volume at 800 vehicles per day.

There are narrow street rights-of-way, however building setbacks at this intersection are just adequate to provide adequate sight distance for an uncontrolled intersection. Large tree trunks do cause a temporary loss of sight distance which can sometimes be more troublesome than larger, more imposing obstructions. Street surfaces are rough.

Traffic volumes at this intersection were so low that it was difficult to determine any clearly defined operating patterns. Vehicles were observed traveling within a normal range of speeds. As with other intersections in this area of town, east-west traffic appears to have claim on thru movements.

There were 12 angle accidents reported during the four year period that this study encompassed. Road conditions were significant at this site since 41% of the accidents occurred on a snowy or icy street surfaces. There was 1 night time accident. Most of the accidents occurred between the hours of 7 AM and noon.

IMPROVEMENTS

The apparent conditions contributing to accidents at this location are sight obstructions caused by low growing trees and parked vehicles. Since sight restrictions which exist at this intersection are not permanent, numerous trees in the area could be trimmed and this intersection could function with yield signs on the minor street, Second Avenue West. All curbs should also be

painted yellow within a minimum distance of 60 feet from the corner radii to ensure sight distance is not blocked by parked vehicles.

Since yield signs only provide a limited margin of safety in some circumstances, the city may want to assess this recommendation prior to implementation. If the yield signs would be a unique situation in Kalispell, stop signs should probably be installed instead. The most important aspect of intersection control is consistency. If consistency is violated, so will driver expectancy. Stop signs would also require less parking removal to accomplish.

Long term improvements do not appear to be applicable to the conditions encountered at this site.

SECOND AVE. W & EIGHTH ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	400
SOUTH APP	300
EAST APP	900
WEST APP	800

EXISTING CONTROL:

	YES
NONE	
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

	YES
PARKING	
YIELD	YES
STOP	
CURB/WALK	
MARKING	
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$825
MDoT FUND	$705
CITY FUND	$120

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	1.2	40%
PDO	3.6	40%

BENEFIT/COST RATIO: 26

	INDEX VALUE	SITE RANK
# ACCIDENTS	72	6
ACCIDENT RATE	99	3
SEVERITY	46	14
VOL/CAPACITY	8	24
SIGHT DIST.	63	18
DRIVER EXPECT	50	24
INFO DEFICIENT	58	19
HAZARD INDEX	62	6
B/C RATIO	71	5

PRIORITY	64.97	4

SITE

NUMBER

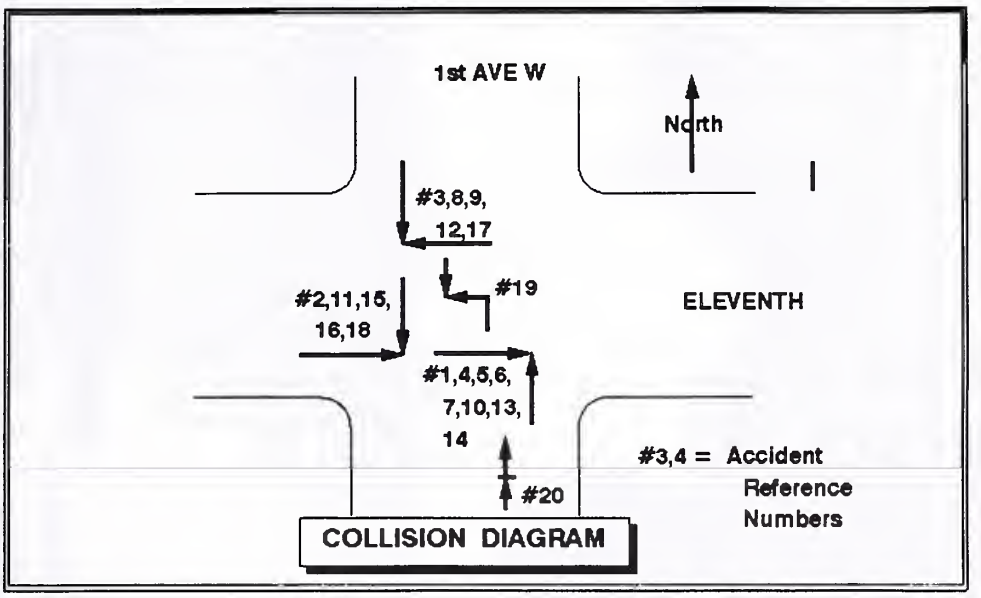
5

FIRST AVENUE WEST

and

ELEVENTH STREET

ACCIDENT SUMMARY
FIRST AVE. W & ELEVENTH



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	6	9	88	748	PROP DAM	CLEAR	DRY	DAY
2	ANGLE	6	24	88	1025	INJURY	CLEAR	DRY	DAY
3	ANGLE	6	26	88	1424	PROP DAM	CLEAR	DRY	DAY
4	ANGLE	7	16	88	800	PROP DAM	CLEAR	DRY	DAY
5	ANGLE	8	27	88	2312	INJURY	CLEAR	DRY	NITE
6	ANGLE	9	16	88	1101	PROP DAM	CLEAR	DRY	DAY
7	ANGLE	11	5	88	1445	PROP DAM	RAIN	WET	DAY
8	ANGLE	11	11	88	1041	PROP DAM	CLEAR	DRY	DAY
9	ANGLE	1	31	89	808	PROP DAM	CLEAR	ICY	DAY
10	ANGLE	5	12	89	620	INJURY	CLEAR	DRY	DAY
11	ANGLE	7	18	89	728	PROP DAM	CLEAR	DRY	DAY
12	ANGLE	8	22	89	1014	PROP DAM	CLEAR	DRY	DAY
13	ANGLE	3	22	90	1015	PROP DAM	SNOW	ICY	DAY
14	ANGLE	9	29	90	1705	PROP DAM	CLEAR	DRY	DAY
15	ANGLE	3	12	91	1710	PROP DAM	RAIN	WET	DAY
16	ANGLE	5	7	91	1507	PROP DAM	CLEAR	DRY	DAY
17	ANGLE	6	12	91	1725	PROP DAM	CLEAR	DRY	DAY
18	ANGLE	8	24	91	112	PROP DAM	CLEAR	DRY	NITE
19	LEFT TURN	6	12	90	1750	INJURY	CLEAR	DRY	DAY
20	REAREND	4	8	91	1743	INJURY	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR		
8	1988	#INJ ACC	5
4	1989	#FAT ACC	0
3	1990	#PDO ACC	15
5	1991	PERSON =	7 *
20	TOTAL	NIGHTIME	10%

TYPES	NUMBER	ROAD	
ANGLE	18	DRY	80%
REAR END	1	WET	10%
SIDESWIPE	0	SNOW	0%
LEFT TRN	1	ICE	10%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

FIRST AVENUE WEST

Looking South

Looking East

ELEVENTH STREET

Looking West

TRAFFIC OPERATIONS

First Avenue West is a Federal Aid Urban Street which is west of and parallel to Main Street (US 93). Eleventh Street marks the southern end of the FAU designation on First and serves as the main access between Main and First. East-west traffic also uses Eleventh to cross Main, since the Eleventh and Main intersection is signalized. Even though their intersection is in the middle of a residential area, their are high traffic volumes entering this intersection. The major traffic flow is in the north-south direction, but there are heavy southbound left turn and westbound right turn movements because of the access to Main Street, one block east.

Both streets have tree lined boulevards with large deciduous trees. Parking is allowed on both sides of the street and demand for parking appears to be light. Parking restrictions at the corners are not marked. The existing intersection is controlled by stop signs on Eleventh Street and there is a double yellow centerline on First Avenue. The stop signs, while not blocked by trees, are minimum size and located at inconsistent locations. There are no indications on the Eleventh Street approaches, other than the stop signs, that First Avenue is a major traffic carrying street.

Traffic observations indicate that the intersection becomes fairly congested at certain times of the day and heavy left turn movements from the southbound direction contribute to that condition. The left turn movements also creates conflicts since vehicles stopped in the traffic lane waiting to turn left block the line of sight from the side street while Second Ave. thru traffic tends to pass on the right, when there is room. Because of congestion, Eleventh Street traffic backs up on the westbound approach. Thru and left turning vehicles tend to pull along side right turning traffic on the westbound approach thereby blocking the line of sight for both vehicles. All of these problems are complicated by the intermittent sight restrictions caused by tree trunks and occasional vehicles parked near the intersection.

There were 18 angle, 1 left turn and 1 rearend accident reported during the four year period that this study encompassed. Road conditions were not a significant factor at this site since only 10% of the accidents occurred on a snowy or icy street surfaces. There were only 2 night time accidents. Accidents appear to be clustered around peak morning and afternoon traffic periods. Almost all of the accidents occurred during June, July and August.

IMPROVEMENTS

The apparent conditions contributing to accidents at this location are high traffic volumes and heavy turning movements where there are no traffic control provisions adequate to handle those conditions. The primary recommended improvement would focus on efficiency, which will necessarily improve safety. Left turn bays should be marked on First Avenue West and necessary parking restrictions be implemented to effect the new lane designations. The turn lane designations should match the same recommendations being proposed at the Twelfth Street intersection, one block south. The new left turn lanes will alert First Avenue drivers to the fact that they are approaching an intersection different than previous intersections encountered. They will also provide a defined location for storing left turn vehicles while providing side street traffic a line of sight and the knowledge that thru traffic is unimpeded by the stored vehicle. The turn lanes also have the benefit of eliminating parking for a significant distance on either side of the intersection, which will eliminate occasional sight obstructions. Six of the angle accidents clearly involved drivers who had stopped for the signs, but still pulled out into the path of oncoming traffic.

To reduce the frequency of vehicles who do not stop for the signs, it is recommended that new oversize stop signs be installed at standard locations and parking in advance of the signs be restricted and marked. Marking of a centerline and stop bars on Eleventh will provide additional emphasis on the stop condition. This is especially critical for eastbound traffic, since drivers can see the signal at the Main Street intersection and tend to drive at the signal and ignore the intersection at hand.

Long Term Improvements at this site should be implemented when traffic volumes on First Avenue increase by approximately 15% and extensive efficiency improvements are required. The corridor section of this report indicates that a continuous left turn lane should be considered with these circumstances. In that case, signing and pavement markings on First could be modified to accommodate the long term solution. Significant volume increases on First may also warrant signalization of this intersection. All recommendations at this site should be reviewed with the benefit of proposed actions that may be included in the new transportation plan.

FIRST AVE. W & ELEVENTH ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	6000
SOUTH APP	4600
EAST APP	4000
WEST APP	3100

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	YES
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$3,515
MDoT FUND	$3,425
CITY FUND	$90

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	3.2	53%
PDO	9.0	60%

BENEFIT/COST RATIO: 18

	INDEX VALUE	SITE RANK
# ACCIDENTS	85	1
ACCIDENT RATE	35	15
SEVERITY	50	7
VOL/CAPACITY	69	6
SIGHT DIST.	100	11
DRIVER EXPECT	63	13
INFO DEFICIENT	67	11
HAZARD INDEX	61.3	7
B/C RATIO	62	6

PRIORITY	61.53	5

SITE

NUMBER

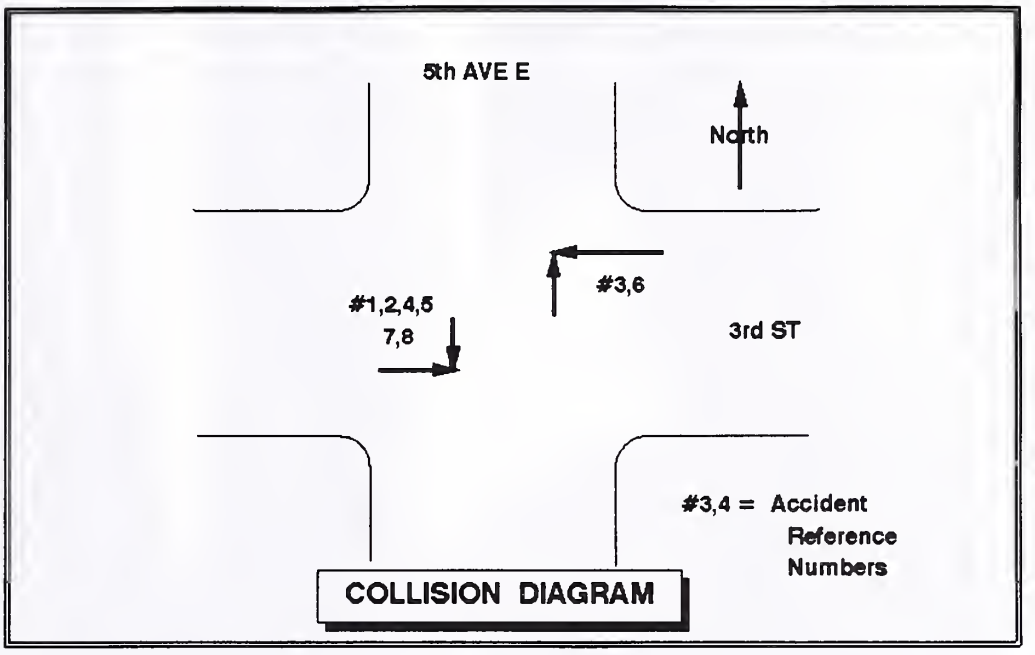
6

FIFTH AVENUE EAST

and

THIRD STREET

ACCIDENT SUMMARY
FIFTH AVE. E & THIRD ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	6	29	88	1136	PROP DAM	RAIN	WET	DAY
2	ANGLE	11	29	88	1539	PROP DAM	CLEAR	SNOW	DAY
3	ANGLE	12	6	88	903	INJURY	SNOW	SNOW	DAY
4	ANGLE	1	17	89	1257	PROP DAM	CLEAR	DRY	DAY
5	ANGLE	1	17	89	1257	PROP DAM	CLEAR	DRY	DAY
6	ANGLE	3	17	89	1228	PROP DAM	CLEAR	ICY	DAY
7	ANGLE	7	14	89	1825	INJURY	CLEAR	DRY	DAY
8	ANGLE	9	16	90	1635	INJURY	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
3	1988	#INJ ACC	3	
4	1989	#FAT ACC	0	
1	1990	#PDO ACC	5	
0	1991	PERSON =	3	*
8	TOTAL	NIGHTIME	0%	

TYPES	NUMBER	ROAD	
ANGLE	8	DRY	50%
REAR END	0	WET	13%
SIDESWIPE	0	SNOW	25%
LEFT TRN	0	ICE	13%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

FIFTH AVENUE EAST

Looking South

Looking East

THIRD STREET

Looking West

TRAFFIC OPERATIONS

Third Street is a local east-west street and Fifth Avenue East is a local north-south street. Their intersection is in the middle of a residential area. The intersection is located one block south of Second Street a major east-west street and one block east of Fourth Avenue a one-way northbound major street. Both streets have tree lined boulevards with large deciduous trees. Parking is allowed on both sides of the street and demand for parking appears to be moderate to high. Parking at this site conforms to Murphy's Fifth Law of Traffic Engineering, ie. "No matter how many vehicles are parked on a street, they will all be as close to the intersection as possible". Traffic volumes on Fifth Avenue are low, while Third Street has about double the volume at 950 vehicles per day.

Sight distance is especially bad in the northwest corner because of a picket fence and bushes in the yard. Narrow street right-of-way and inadequate building setbacks at this intersection cause intrusion of permanent obstructions within the sight triangle required for uncontrolled intersections. Large tree trunks in wide boulevards also cause a temporary loss of sight distance which can sometimes be more troublesome than larger, more imposing obstructions. Street surface are smooth and uniform.

It was noted that east-west traffic was the most reluctant to change speed on the approach to the intersection, especially in the eastbound direction. East-west vehicles also travel at a higher rate of speed than do north-south vehicles.

There were 8 angle accidents reported during the four year period that this study encompassed. All but two of the accidents involved northbound and westbound vehicles. Road conditions had some significance at this site since 38% of the accidents occurred on a snowy or icy street surfaces. There were no night time accidents. Most of the accidents occurred near the noon hour.

IMPROVEMENTS

Since permanent sight restrictions exist in all corners of this intersection and there is sufficient evidence that it cannot function reasonably well as an uncontrolled intersection, vehicle right-of-way control is indicated. Yield signs cannot be used because yield signs require the same unobtrusive line of sight that is necessary for uncontrolled intersections. Therefore, stop sign control is recommended for the lesser volume, Fifth Avenue East. There are stop signs at the intersections both north and south of this location and from observations, it appears that vehicles expect to slow or stop in the north and south directions.

Since this site is located near Woodland Park and near a historic mansion that is a tourist attraction, it is conceivable that a significant number of drivers not familiar with the area enter this intersection. It is therefore especially important that street name signs are highly visible. The existing black on white street name signs should be replaced with newer white on green reflective signs.

Yellow curbs should be painted in the intersection area to reduce the possibility of vehicles parking too close to the intersection. Trees on the approach to the new stop sign installation should be trimmed to provide an unimpeded view of the stop signs. Because of moderate to high parking demand in the area and the need to restrict parking even when the curb may be obscured by snow or leaves, parking signs should also be installed.

Long term improvements do not appear to be applicable to the conditions encountered at this site.

FIFTH AVE. E & THIRD ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	600
SOUTH APP	500
EAST APP	950
WEST APP	950

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$1,260
MDoT FUND	$1,090
CITY FUND	$170

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	2.1	70%
PDO	3.5	70%

BENEFIT/COST RATIO: 27

	INDEX VALUE	SITE RANK
# ACCIDENTS	61	15
ACCIDENT RATE	66	8
SEVERITY	50	6
VOL/CAPACITY	13	21
SIGHT DIST.	72	16
DRIVER EXPECT	50	23
INFO DEFICIENT	58	18
HAZARD INDEX	54.7	19
B/C RATIO	71	4

PRIORITY	60.08	6

SITE

NUMBER

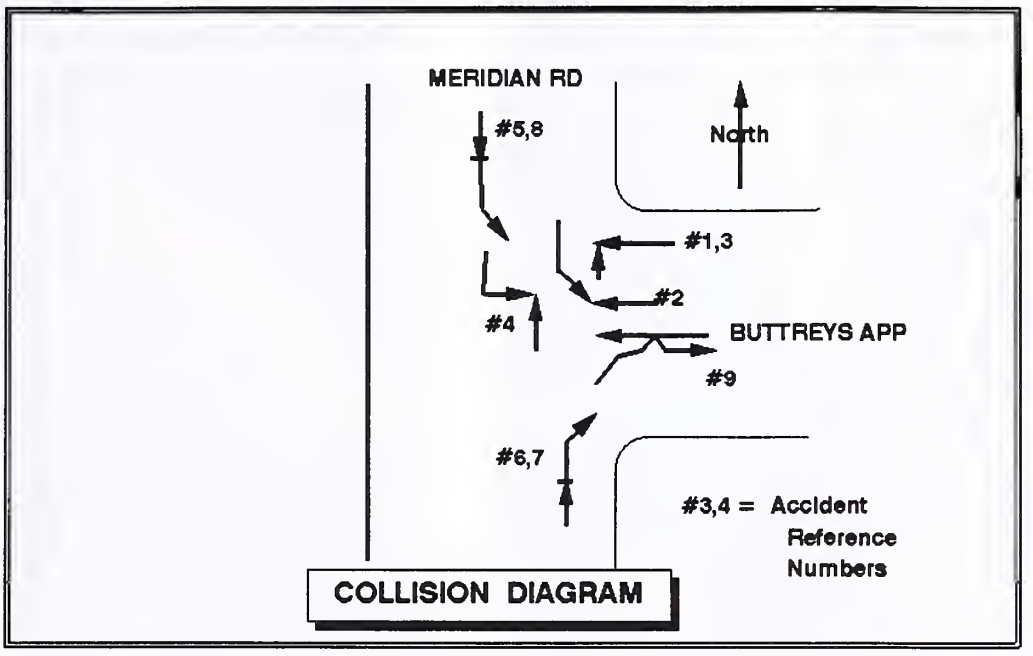
7

MERIDIAN ROAD

and

BUTTREY"S ACCESS

ACCIDENT SUMMARY
MERIDIAN RD & BUTTREYS' APP.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	10	6	88	945	PROP DAM	CLEAR	DRY	DAY
2	ANGLE	11	18	88	1548	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	3	19	90	828	PROP DAM	RAIN	WET	DAY
4	LEFT TURN	4	9	88	1515	INJURY	CLEAR	DRY	DAY
5	REAREND	2	24	89	1248	PROP DAM	RAIN	WET	DAY
6	REAREND	12	13	89	1701	PROP DAM	SNOW	ICY	NITE
7	REAREND	2	20	90	1440	PROP DAM	SNOW	SNOW	DAY
8	REAREND	10	30	91	1459	PROP DAM	CLEAR	DRY	DAY
9	SIDESWIPE	6	11	91	1929	PROP DAM	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR		
3	1988	#INJ ACC	1
2	1989	#FAT ACC	0
2	1990	#PDO ACC	8
2	1991	PERSON =	5 *
9	TOTAL	NIGHTIME	25%

TYPES	NUMBER	ROAD	
ANGLE	3	DRY	56%
REAR END	4	WET	22%
SIDESWIPE	1	SNOW	11%
LEFT TRN	1	ICE	11%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

MERIDIAN ROAD

Looking South

Looking North

BUTTREY'S ACCESS

Looking West

TRAFFIC OPERATIONS

Meridian Road is a north-south arterial on the west end of Kalispell. It intersects Idaho Street (US 2), which is a major east-west arterial through the city. The Buttreys super market is located in the southeast corner of this intersection and a prime access to this store is located just south of the intersection.

Meridian Road, at the access point, provides three traffic lanes including a continuous left turn lane. The northbound approach to the intersection with Idaho provides three traffic lanes, each accommodating a separate turn movement. The only signing at the access point are 4 private signs that all read "Enter".

There were many operational problems observed at this location. The following are some of the more critical:

1. The approach is located too close to the major intersection of Meridian and Idaho. Northbound approach traffic at the intersection had queue formations which block the Buttrey's approach approximately 75% of all peak hour signal cycles. This blockage causes queue formations within the Buttreys' lot and southbound left turning vehicles are left stranded in the middle of the street.

2. Since the approach is too close to the intersection, bay tapers for right and left turn lanes on the northbound intersection approach are too abrupt. Traffic approaching the intersection in the northbound direction cannot visually perceive the lane transitions and the Buttreys' approach appears to be part of the right turn lane. This situation causes many drivers to make premature lane changes which results in erratic maneuvers.

3. There is no room to develop an adequate left turn bay into the Buttreys' approach from the north. Existing markings actually make the left turn movement illegal, because vehicles are required to cross a double yellow line to make the turn. In addition, the actual storage area for southbound left turning vehicles can only accommodate one passenger car.

4. Meridian is only 35' wide, BC to BC. In order to safely handle three lanes of traffic, it should be a minimum of 40' wide.

5. Semi tractor trailers trying to negotiate a right turn onto Idaho in the northbound direction, must use the middle lane to negotiate the turn. Several instances were observed when a vehicle has been trapped in the right turn lane while trucks turned right in front of their path.

6. The approach grade to the Buttreys' lot is sharp and abrupt. When considering the limited time available for traffic gaps, the approach geometry creates adverse conditions for driving judgment and control of vehicles.

7. The enter signs leaves no doubt that traffic can access Buttreys from Meridian, but cause confusion for the exit maneuver. Drivers unfamiliar with the location tend to assume that it is a one-way entrance and sometimes enter on the left hand side of the approach.

8. There are no stop signs at the approach. Even though they are not required for a curb approach, traffic volumes at this location would warrant traffic control in excess of a standard curb approach.

9. The intersection of Idaho and Meridian has inefficient phasing and lane control operational characteristics. The peak hour cycle length averages 130 seconds and operates in a rotational scheme. Delays at this intersection cause drivers to be extremely aggressive by the time they get to the uncontrolled Buttreys' access.

There were 9 accidents at this location during the study reporting period. These accidents included 3 angle, 1 left turn, 4 rearend and 1 sideswipe accident. Forty four percent of the accidents occurred on snowy or icy streets and 25% occurred during night time hours. The majority of accidents happened during the late afternoon, peak traffic periods. Accident severity was high with nine accidents producing 5 injuries. The number of accidents at this site could be considered low when conflict conditions and traffic volumes

are considered. The only reason more accidents haven't occurred is probably due to the fact that this intersection appears to be dangerous and drivers usually approach with due caution.

IMPROVEMENTS

Various alternative improvements were conceived to improve safety at this intersection. Some of them included modification of the northbound right turn lane to include the Buttreys' right turn movement and modifying the intersection of Idaho and Meridian to improve efficiency and reduce queue build up back to the access point. Since none of these concepts completely solved the problems inherent with this site, the only meaningful alternative remaining would be relocation of the Buttreys' access. Therefore, the recommended improvement found within this study requires that the approach be relocated a minimum of 100 feet south of its existing location. This would allow adequate room to properly develop turn lanes on Meridian into Buttreys and at the intersection with Idaho. The short term improvement sketch indicates the minimum improvements necessary to effect this recommendation. These improvements would eliminate most of the above noted problems discovered at this site.

Because of the complex nature of this problem, all of the implications and variations associated with this recommendation would require a much more detailed planning and design effort prior to implementation. Full cooperation of the private land owners would be necessary to make these or any other improvements at this location. Since the recommended improvements represent a fairly sizeable capital investment, it may be desirable to look at long term improvements that may be set forth in the transportation plan and develop only those short term improvements which may be salvageable in the future.

Future traffic growth will undoubtedly require widening of Meridian to provide basic street capacity. Sufficient traffic growth may also warrant a signal at this approach. This would be undesirable because of limited separation between the Idaho Street signal. Long term improvements may also include an entire reevaluation of Buttreys access and circulation patterns and development of totally new access locations and control.

MERIDIAN RD & BUTTREYS' ACCESS

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	10000
SOUTH APP	10300
EAST APP	3000
WEST APP	

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	
YIELD	
STOP	YES
CURB/WALK	YES
MARKING	YES
WARNING	
CONSTRUCT	YES

ESTIMATED COST:

TOTAL	$14,110
MDoT FUND	$2,710
CITY FUND	$11,400

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.8	80%
PDO	5.5	69%

BENEFIT/COST RATIO: 11

	INDEX VALUE	SITE RANK
# ACCIDENTS	64	12
ACCIDENT RATE	14	24
SEVERITY	59	3
VOL/CAPACITY	56	8
SIGHT DIST.	100	3
DRIVER EXPECT	94	2
INFO DEFICIENT	100	3
HAZARD INDEX	62.2	5
B/C RATIO	52	10

PRIORITY	58.83	7

SITE

NUMBER

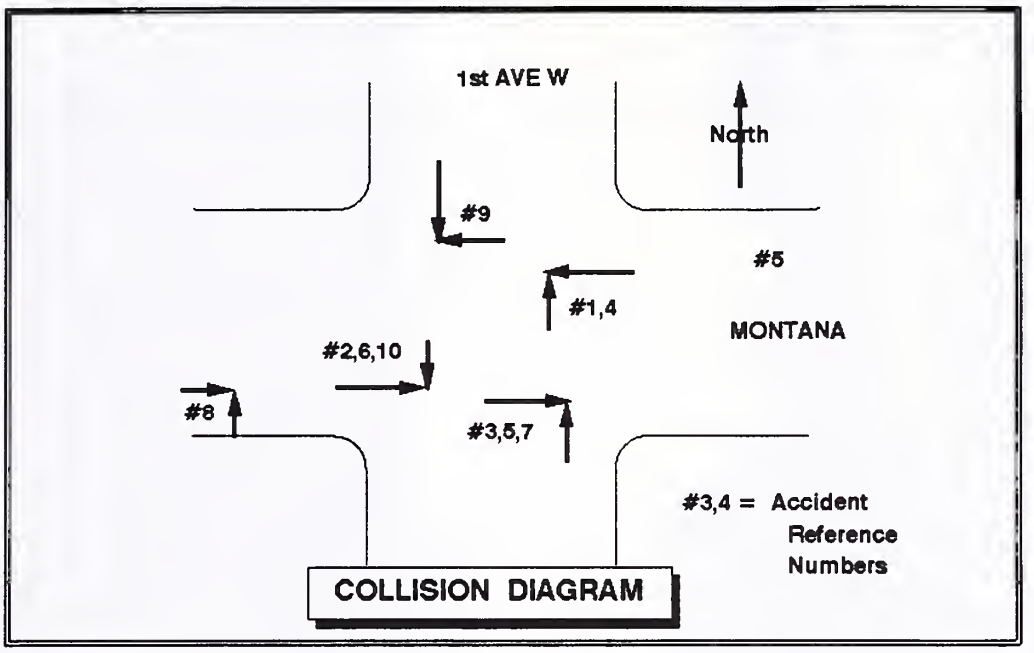
8

FIRST AVENUE WEST

and

MONTANA STREET

ACCIDENT SUMMARY
FIRST AVE. W & MONTANA



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	8	10	88	1231	PROP DAM	CLEAR	DRY	DAY
2	ANGLE	11	3	88	1543	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	2	24	89	2330	PROP DAM	RAIN	WET	NITE
4	ANGLE	8	17	89	1753	PROP DAM	CLEAR	DRY	DAY
5	ANGLE	8	19	89	145	PROP DAM	CLEAR	DRY	NITE
6	ANGLE	6	29	90	1621	PROP DAM	CLEAR	DRY	DAY
7	ANGLE	9	14	90	814	INJURY	CLEAR	DRY	DAY
8	ANGLE	10	23	90	1619	PROP DAM	CLEAR	DRY	DAY
9	ANGLE	2	7	91	955	PROP DAM	CLEAR	DRY	DAY
10	ANGLE	9	11	91	1545	PROP DAM	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR		
2	1988	#INJ ACC	1
3	1989	#FAT ACC	0
3	1990	#PDO ACC	9
2	1991	PERSON =	1 *
10	TOTAL	NIGHTIME	20%

TYPES	NUMBER	ROAD	
ANGLE	10	DRY	90%
REAR END	0	WET	10%
SIDESWIPE	0	SNOW	0%
LEFT TRN	0	ICE	0%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

FIRST AVENUE WEST

Looking South

Looking East

MONTANA STREET

Looking West

TRAFFIC OPERATIONS

Montana Street is a local east-west street which is one block south of and parallel to Idaho Street (US 2). It is also one block north of Center Mall, a large shopping development on the northern fringe of the Central Business District. Montana Street carries spill-over traffic from both Idaho Street and Main Street because of congestion at their intersection northeast of this study site. It also caries circulation traffic from Center Mall and from businesses which front on Idaho Street. First Avenue West is a local street at this location. Continuity of First Avenue is interrupted by Center Mall. It currently serves circulation traffic from Center Mall and from businesses fronting on Idaho Street. Surrounding land use at this site consists of retail and light industrial businesses. This intersection is one of three intersections on Montana Street, west of Main which are included in this study. As such, it shares some common characteristics as part of a corridor. Discussions regarding this corridor can be found in the main body of this report.

There are no traffic control devices existing at this intersection. Considering the relatively high traffic volumes and differences in magnitude on the approach legs, some of the operational characteristics observed at this site could be expected. The following are the more serious operational deficiencies noted:

1. Buildings in the corners on the south side of the intersection are so close to the curb line that no prudent driver could enter the intersection without stopping.

2. Curb is missing in the southeast quadrant of the intersection and vehicles park directly within the area where a curb radius would be located. There are long lengths of laydown curb on the south side of the street which accommodates parking up to and including the intersection corner. The same type of curb exists in the northwest corner and serves as an access to a gas station and shop. Vehicles, including semi tractor trailers, park at any location, in and out of the lot, that they feel like. With this variety of parking options intersection line of sight is very poor. More importantly, the sight obstructions are mobile and changes constantly.

3. Speeds on Montana Street are significantly faster than on First Avenue and at least 70 % of First Avenue traffic slows or stops before entering the intersection. Only 10% of Montana Street thru traffic even slows before entering.

4. Lack of positive guidance, in the form of pavement markings, allows a wide range in vehicles paths within, thru and around the intersection.

5. Uncontrolled access also allows many and varied conflict maneuvers within the intersection area which are too numerous to described.

6. Power poles on the south side of the road are located approximately six feet behind the edge of pavement. Since there is no curb, they present a hazard to errant vehicles.

7. One disturbing observation was noted during the morning hours. A steam vent pipe, coming from the building in the southwest corner of the intersection, blew steam with sufficient pressure to completely engulf the entire street. The zero visibility fog was instantaneous and, needless to say, completely unexpected. This type of activity would not only cause loss of visibility but the surprise factor could easily cause some drivers to overreact.

There were 10 angle accidents at this location during the four year reporting period. These accidents involved all directions of travel. Ninety percent of the accidents occurred on clear dry roads. Twenty of the accidents occurred during night time hours. The majority of accidents happened during the morning and evening peak hour traffic periods during the summer.

IMPROVEMENTS

Sight obstructions, higher traffic volumes and unbalanced traffic flow along with the fact that accidents cluster at this site, provides a clear indication that stop signs are warranted on the First Avenue West approaches. This

condition is so obvious to the average driver that the vast majority drive the intersection as if the stop signs already exist.

Pavement markings at this intersection are considered necessary to provide positive guidance and to add a measure of safety. A double yellow centerline should be painted on Montana Street and at least 50 feet on the First Avenue approaches. Stop bars should also be installed on the stop approaches to reinforce the stop condition. New standard street name signs should also be consider a vital part of the improvements since there are many non-local drivers using this intersection, circulating from adjacent businesses.

Because of uncontrolled access at this location and uncontrolled parking conditions at the intersection corners, construction of curb/gutter and sidewalk sections would be the only feasible options available to clear the intersection area and provide some semblance of orderly traffic flow. The sight improvement sketch indicates the physical improvements and parking restrictions necessary to insure safe operations at this intersection.

Though not included in the improvement sketches, it is critical that the City of Kalispell contact the owners of the business in the southwest corner and determine the reason why they must produce blinding fog. If nothing else, the problems' solution may be as simple as installing a 90 degree elbow (skyward) on the steam exhaust vent.

Future street system improvements in this area of Kalispell may reduce traffic demand at this location to some degree, but traffic volumes should be expected to increase prior to any significant system changes. Long term improvements which should be considered at this site would include a construction project to include curb/gutter and sidewalk, uniformly in this area. The northeast corner of this intersection is a good example of proper building setback and access control features that should be the model for future improvements in this area.

FIRST AVE. W & MONTANA ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	1500
SOUTH APP	800
EAST APP	2000
WEST APP	1900

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	YES
MARKING	YES
WARNING	
CONSTRUCT	

ESTIMATED COST:

TOTAL	$4,904
MDoT FUND	$1,659
CITY FUND	$3,245

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.7	70%
PDO	6.3	70%

BENEFIT/COST RATIO: 8

	INDEX VALUE	SITE RANK
# ACCIDENTS	67	7
ACCIDENT RATE	47	12
SEVERITY	40	22
VOL/CAPACITY	31	13
SIGHT DIST.	100	8
DRIVER EXPECT	100	1
INFO DEFICIENT	100	2
HAZARD INDEX	65.3	2
B/C RATIO	44	13

PRIORITY	58.27	8

SITE

NUMBER

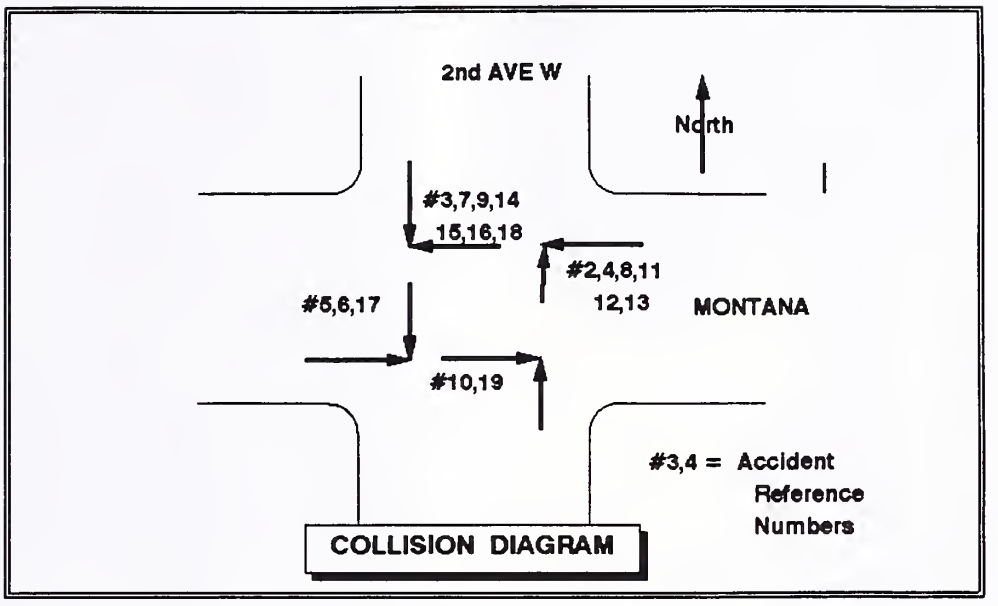
9

SECOND AVENUE WEST

and

MONTANA STREET

ACCIDENT SUMMARY
SECOND AVE. W & MONTANA



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	3	26	88	150	PROP DAM	RAIN	WET	NITE
2	ANGLE	3	30	88	1809	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	6	15	88	1630	PROP DAM	CLEAR	DRY	DAY
4	ANGLE	8	3	88	1838	PROP DAM	CLEAR	DRY	DAY
5	ANGLE	8	25	88	1052	PROP DAM	CLEAR	DRY	DAY
6	ANGLE	12	8	88	1542	PROP DAM	SNOW	SNOW	DAY
7	ANGLE	1	12	89	1440	PROP DAM	CLEAR	ICY	DAY
8	ANGLE	3	21	89	1453	INJURY	CLEAR	DRY	DAY
9	ANGLE	7	21	89	2002	INJURY	CLEAR	DRY	DAY
10	ANGLE	7	27	89	1808	PROP DAM	RAIN	WET	DAY
11	ANGLE	9	14	89	1455	PROP DAM	CLEAR	DRY	DAY
12	ANGLE	2	14	90	1435	PROP DAM	CLEAR	DRY	DAY
13	ANGLE	4	29	90	1420	PROP DAM	CLEAR	DRY	DAY
14	ANGLE	5	29	90	1723	PROP DAM	CLEAR	WET	DAY
15	ANGLE	6	13	90	1902	PROP DAM	RAIN	DRY	DAY
16	ANGLE	8	1	90	1700	PROP DAM	CLEAR	DRY	DAY
17	ANGLE	8	1	90	1940	INJURY	CLEAR	DRY	DAY
18	ANGLE	12	22	90	1000	PROP DAM	CLEAR	ICY	DAY
19	LEFT TURN	12	31	90	1405	PROP DAM	SNOW	ICY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
6	1988	#INJ ACC	3	
6	1989	#FAT ACC	0	
7	1990	#PDO ACC	16	
0	1991	PERSON =	4	*
19	TOTAL	NIGHTIME	5%	

TYPES	NUMBER	ROAD	
ANGLE	19	DRY	63%
REAR END	0	WET	16%
SIDESWIPE	0	SNOW	5%
LEFT TRN	0	ICE	16%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

SECOND AVENUE WEST

Looking South

Looking East

MONTANA STREET

Looking West

TRAFFIC OPERATIONS

Montana Street is a local east-west street which is one block south of and parallel to Idaho Street (US 2). It is also one block north of Center Mall, a large shopping development on the northern fringe of the Central Business District. Montana Street carries spill-over traffic from both Idaho Street and Main Street because of congestion at their intersection northeast of this study site. It also caries circulation traffic from Center Mall and from businesses which front on Idaho Street. Second Avenue West is a local street. Continuity of Second Avenue is interrupted by Center Mall. It currently serves circulation traffic from Center Mall and from businesses fronting on Idaho Street. Surrounding land use at this site consists of retail and light industrial businesses. This intersection is one of three intersections on Montana Street, west of Main which are included in this study. As such, it shares some common characteristics as part of a corridor. Discussions regarding this corridor can be found in the main body of this report.

The intersection is currently controlled by stop signs on Second Avenue West. No other traffic control devices exist at this location. There are no parking restrictions near the corners and parking demand is moderate to heavy. The southbound stop sign is partly obscured by tree branches. Curb and gutter exists in all quadrants, but is severely deteriorated on the north side of the street east of the intersection.

There were 19 angle accidents at this location during the four year reporting period. None of these accidents occurred in 1991. These accidents encompassed all directions of travel, with the majority involving northbound vehicles. Sixty three percent of the accidents occurred on clear dry roads. Only 5% of the accidents occurred during night time hours. Almost all of the accidents occurred between the hours of 2 and 7 PM.

Difficulties in determining operational problems of sufficient magnitude to cause such a high accident rate at this location were encountered during field observations. Further analysis indicated that this intersection had been experiencing six or more angle accidents per year until 1991. Additional efforts were made to search for missing accident reports, which was futile. After talking with Donald Hossack regarding this situation, he informed us that

the stop signs were installed in early 1991. According to these records, the stop sign effectively eliminated accidents at this critically high accident rate location.

IMPROVEMENTS

Even though the new stop signs have produced a 100% reduction in accidents based on one years data, statistics would indicate that 1991 was an anomaly. Over the long run, the most optimistic reductions would be approximately 70% and it is anticipated that one or two accidents per year could still be expected at this intersection. In order to further improve the probability of limiting incidents to chance accidents at this location, mobile sight obstructions must be totally eliminated. The short terms improvement sketch indicates the necessary signing and markings necessary to control parking near the intersection. The parking setbacks were computed using a dynamic vehicle model which considers gap requirements to cross Montana and 85th% vehicle speeds. In addition, some trimming of trees would be necessary to clear all obstruction from the intersection area.

As with the adjacent intersection with First Avenue, pavement markings at this intersection are considered necessary to provide positive guidance and to add a measure of safety. A double yellow centerline should be painted on Montana Street.

Future street system improvements in this area of Kalispell may reduce traffic demand at this location to some degree, but traffic volumes should be expected to increase prior to any significant system changes. Long term improvements will be highly dependent upon the future status of area street operations.

SECOND AVE. W & MONTANA ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	1100
SOUTH APP	900
EAST APP	1900
WEST APP	2200

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	
CURB/WALK	
MARKING	YES
WARNING	
CONSTRUCT	

ESTIMATED COST:

TOTAL	$565
MDoT FUND	$465
CITY FUND	$100

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.3	10%
PDO	1.8	10%

BENEFIT/COST RATIO: 12

	INDEX VALUE	SITE RANK
# ACCIDENTS	84	2
ACCIDENT RATE	76	5
SEVERITY	45	16
VOL/CAPACITY	24	14
SIGHT DIST.	100	1
DRIVER EXPECT	33	25
INFO DEFICIENT	54	25
HAZARD INDEX	59.7	8
B/C RATIO	55	8

PRIORITY	58.15	9

SITE

NUMBER

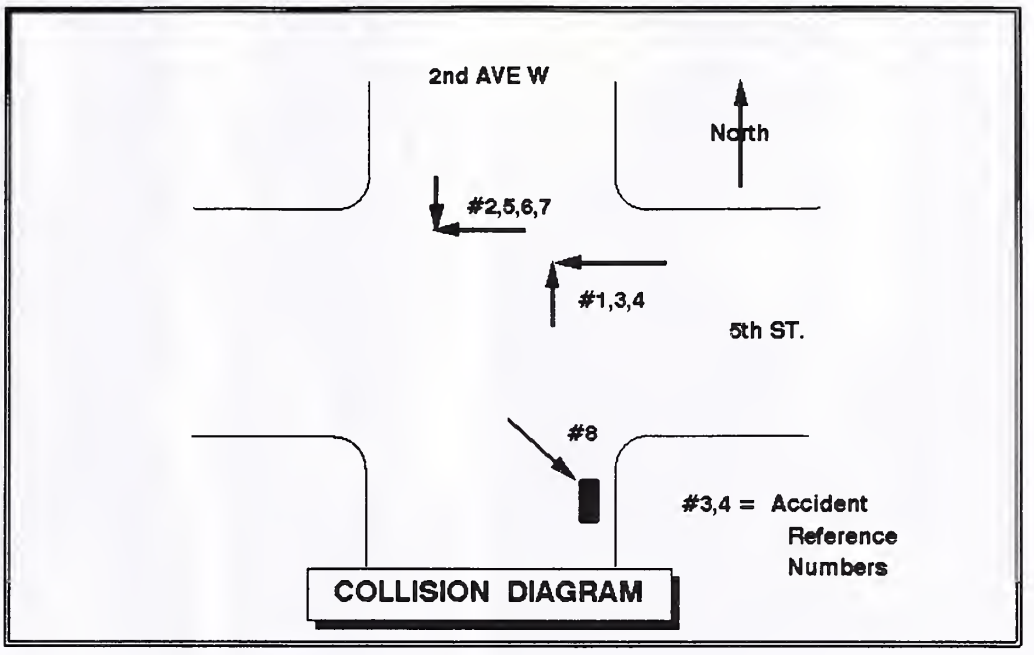
10

SECOND AVENUE WEST

and

FIFTH STREET

ACCIDENT SUMMARY
SECOND AVE. W & FIFTH ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	5	9	88	1457	PROP DAM	RAIN	WET	DAY
2	ANGLE	2	1	89	1526	PROP DAM	SNOW	ICY	DAY
3	ANGLE	2	23	89	816	PROP DAM	CLEAR	ICY	DAY
4	ANGLE	2	28	89	815	PROP DAM	SNOW	SNOW	DAY
5	ANGLE	12	28	89	1350	INJURY	SNOW	ICY	DAY
6	ANGLE	12	3	90	810	PROP DAM	SNOW	ICY	DAY
7	ANGLE	12	28	91	1445	PROP DAM	CLEAR	DRY	DAY
8	PARKED VEH	8	31	91	1334	PROP DAM	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
1	1988	#INJ ACC	1	
4	1989	#FAT ACC	0	
1	1990	#PDO ACC	7	
2	1991	PERSON =	1	*
8	TOTAL	NIGHTIME	0%	

TYPES	NUMBER	ROAD	
ANGLE	7	DRY	25%
REAR END	0	WET	13%
SIDESWIPE	0	SNOW	13%
LEFT TRN	0	ICE	50%
OTHER	1	OTHER	0%

*** No. of Persons Injured**

Looking North

SECOND AVENUE WEST

Looking South

Looking East

FIFTH STREET

Looking West

TRAFFIC OPERATIONS

Fifth Street is a local east-west street and Second Avenue West is a local north-south street. Their intersection is in the middle ofa residential area approximately one block east of the Elrod Elementary School. Another study site is located on Fifth Street one block west. The area is an older neighborhood and curb/gutter, sidewalks and boulevard are all mature. Both streets have tree lined boulevards with large deciduous trees. Parking is allowed on both sides of the street and demand for parking appears to be moderate to high. Traffic volumes on Second Avenue are low, while Fifth Street has slightly higher volumes.

Sight distance is especially bad in the southwest and northwest corners due to houses and dense trees. Narrow street right-of-way and inadequate building setbacks at this intersection cause intrusion of permanent obstructions within the sight triangle required for uncontrolled intersections. Large tree trunks also cause a temporary loss of sight distance which can sometimes be more troublesome than larger, more imposing obstructions. Street surface are smooth and uniform compared with other sections of street in this area.

There were no clear patterns of driver behavior or traffic operations to indicate a predominant assumption of right-of-way. However, as at most intersections in this area east-west traffic had a slight edge in oblivious reaction upon approaching and entering the intersection.

There were 7 angle accidents reported during the four year period that this study encompassed. One other accident involved a collision with a parked car near the southeast corner. All of the angle accidents involved westbound vehicles. Road conditions were significant at this site since 63% of the accidents occurred on snowy or icy street surfaces. There were no night time accidents. Almost all of the accidents occurred at a time before school begins and after it lets out. Only one accident (parked vehicle) occurred in the summer months.

IMPROVEMENTS

Since permanent sight restrictions exist in most corners of this intersection and there is sufficient evidence that it cannot function reasonably well as an uncontrolled intersection, vehicle right-of-way control is indicated. Yield signs cannot be used because yield signs require the same unobtrusive line of sight that is necessary for uncontrolled intersections. Therefore, stop sign control is recommended for the lesser volume, Third Avenue West. There are stop signs at the intersections both north and south of this location and from observations, it appears that vehicles expect to slow or stop in the north and south directions.

The accident pattern at this intersection appears to be a classic case of the "Misdirected Attention Syndrome". MAS occurs whenever there is a defect in the roadway or roadside which is obvious to the majority of drivers. Their attention becomes focused on that defect while becoming oblivious to other clear and present dangers. In this case, the large building, trees and parked cars in the southwest and northwest corners of this intersection are an obvious sight obstructions which drivers focus upon when approaching the intersection. While trying to see eastbound vehicles drivers tend to ignore the westbound vehicles. By the time they have satisfied their urge to focus on that single conflict it is too late to react if a westbound vehicle is entering the intersection. The stop signs should eliminate this problem since there would be a clear line of sight in both directions from the stopped position when adequate parking restrictions are implemented.

Yellow curbs should be painted in the intersection area to reduce the possibility of vehicles parking too close to the intersection. Trees on the approach to the new stop sign installation should be trimmed to provide an unimpeded view of the stop signs.

New standard street name signs should also be installed to replace the existing black and white non-reflective signs.

Long term improvements do not appear to be applicable to the conditions encountered at this site.

SECOND AVE. W & FIFTH ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	600
SOUTH APP	500
EAST APP	700
WEST APP	700

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	
WARNING	
CONSTRUCT	

ESTIMATED COST:

TOTAL	$825
MDoT FUND	$705
CITY FUND	$120

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.8	60%
PDO	3.7	53%

BENEFIT/COST RATIO: 16

	INDEX VALUE	SITE RANK
# ACCIDENTS	61	18
ACCIDENT RATE	75	6
SEVERITY	41	20
VOL/CAPACITY	15	18
SIGHT DIST.	51	21
DRIVER EXPECT	58	19
INFO DEFICIENT	58	20
HAZARD INDEX	54.8	18
B/C RATIO	60	7

PRIORITY	56.52	10

SITE

NUMBER

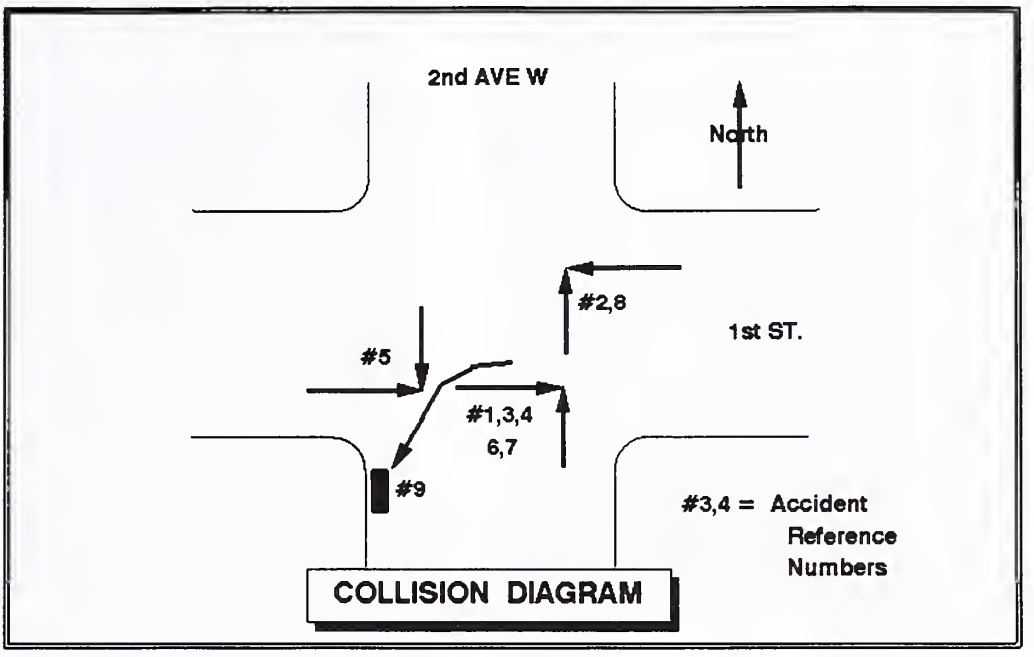
11

SECOND AVENUE WEST

and

FIRST STREET

ACCIDENT SUMMARY
SECOND AVE. W & FIRST ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	1	25	88	1016	PROP DAM	CLEAR	DRY	DAY
2	ANGLE	9	7	88	1021	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	5	18	89	1710	PROP DAM	CLEAR	DRY	DAY
4	ANGLE	11	1	89	1415	PROP DAM	CLEAR	DRY	DAY
5	ANGLE	1	10	90	1310	PROP DAM	CLEAR	DRY	DAY
6	ANGLE	2	8	91	1120	PROP DAM	CLEAR	DRY	DAY
7	ANGLE	9	10	91	1115	PROP DAM	CLEAR	DRY	DAY
8	ANGLE	10	29	91	1518	INJURY	CLEAR	DRY	DAY
9	PARKED VEH	1	9	89	2222	PROP DAM	SNOW	ICY	NITE

ACCIDENT STATISTICS

NO. ACC.	YEAR			
2	1988	#INJ ACC	1	
3	1989	#FAT ACC	0	
1	1990	#PDO ACC	8	
3	1991	PERSON =	2	*
9	TOTAL	NIGHTIME	11%	

TYPES	NUMBER	ROAD	
ANGLE	8	DRY	89%
REAR END	0	WET	0%
SIDESWIPE	0	SNOW	0%
LEFT TRN	0	ICE	11%
OTHER	1	OTHER	0%

*** No. of Persons Injured**

Looking North

SECOND AVENUE WEST

Looking South

Looking East

FIRST STREET

Looking West

TRAFFIC OPERATIONS

First Street is a local east-west street and Second Avenue West is a local north-south street. Their intersection is within the confines of the Central Business District. There are businesses in the north half of the intersection; a large apartment building in the southwest corner; and a parking lot in the southeast corner. The intersection is controlled by stop signs on Second Avenue West. Double yellow centerlines are marked on both streets. Parking restrictions are marked at the corner with yellow curb paint. The parking restrictions are not adequate for conditions encountered and do not comply with distances specified by state law. Parking demand is moderate to heavy depending on the time of day.

Traffic volumes on Second Avenue West are almost twice those on First Street. Observations indicate that drivers are not quite sure who is supposed to stop at the intersection. Many drivers on First tend to slow and look for a sign, especially if they see a vehicle stopped at the sign on Second Avenue.

There were 8 angle accidents reported during the four year period that this study encompassed. One other accident involved a collision with a parked car near the southwest corner. Road conditions were not a significant factor at this site since only 11% of the accidents occurred on a snowy or icy street surfaces. There was one night time accident. Most of the accidents occurred between 10 AM and 2 PM, which would be near peak hour volumes in the downtown area.

IMPROVEMENTS

The most notable traffic control problem at this intersection is the location of stop signs on the major traffic legs of the intersection. Since turning movements at this intersection are not heavy and pedestrian movements are not concentrated in any particular direction, there is no logical reason why the major traffic flow should be required to stop. It has been found that intersections which require the major street to stop have higher accident rates than those which stop the minor leg. The reason is because drivers are creatures of habit. When a certain experience is repeated many times, drivers learn and store that information so that driving reactions become ingrained. Drivers approaching an intersection which requires a stop with never a conflicting vehicle in sight, develop a pattern of disregard for

potential conflicts. After a period of time, the habit is ingrained and the subconscious mind completely blocks out the stop condition. Running the stop sign becomes an automatic behavior which reduces the driving task and lets the drivers cognitive abilities react only to perceived hazards. In this case, where buildings are close to the corner and completely inadequate sight distance exists and there is inadequate time for reaction, subconscious control can be dangerous.

Because of this, it is recommended that the existing stop signs be removed and new, larger stop signs be installed on First Street. The new stop condition should be reinforced by marking stop bars and crosswalks. These will visually inform drivers on First that they must stop and Second Avenue West traffic is not required to stop. In addition, parking restrictions should be marked with yellow curb paint and signing, as indicated in the improvement sketch. It may also be desirable to position portable stop ahead signs at mid-block for a few weeks after the changes are implemented to recondition drivers to the change in operation.

Long term improvements do not appear to be applicable to the conditions encountered at this site.

SECOND AVE. W & FIRST ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	2500
SOUTH APP	2600
EAST APP	1600
WEST APP	1000

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	YES
WARNING	
CONSTRUCT	

ESTIMATED COST:

TOTAL	$1,805
MDoT FUND	$1,745
CITY FUND	$60

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.4	40%
PDO	2.8	35%

BENEFIT/COST RATIO: 7

	INDEX VALUE	SITE RANK
# ACCIDENTS	64	13
ACCIDENT RATE	36	14
SEVERITY	46	15
VOL/CAPACITY	43	10
SIGHT DIST.	100	10
DRIVER EXPECT	92	3
INFO DEFICIENT	75	9
HAZARD INDEX	60.4	8
B/C RATIO	43	15

PRIORITY	54.66	11

SITE

NUMBER

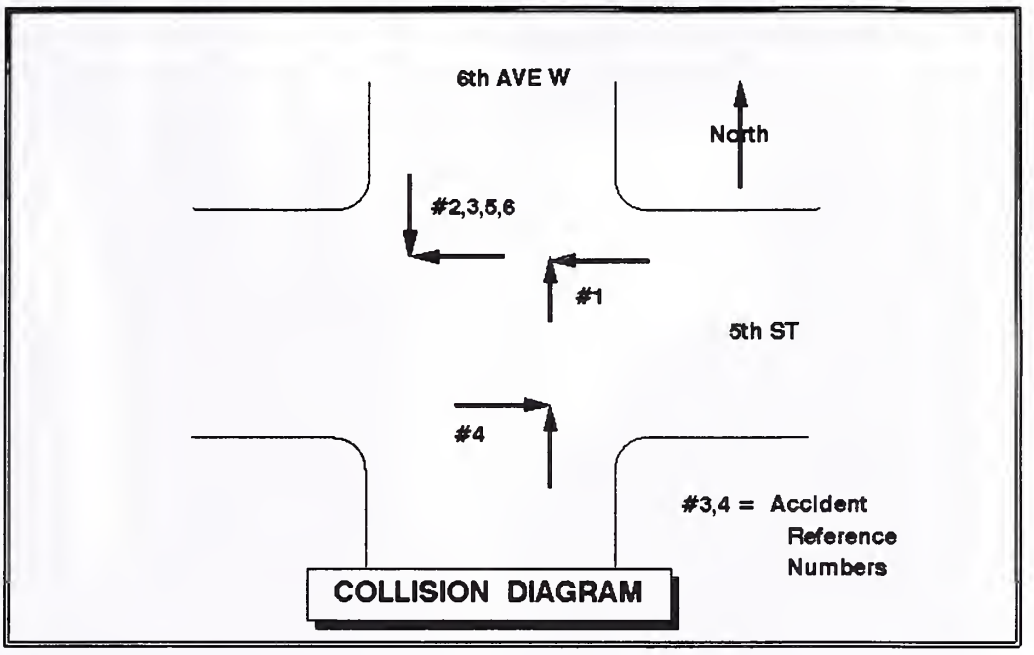
12

SIXTH AVENUE WEST

and

FIFTH STREET

ACCIDENT SUMMARY
SIXTH AVE. W & FIFTH ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	2	9	88	1530	PROP DAM	CLEAR	ICY	DAY
2	ANGLE	12	7	88	1024	PROP DAM	CLEAR	ICY	DAY
3	ANGLE	8	31	89	2012	PROP DAM	CLEAR	DRY	DAY
4	ANGLE	2	13	90	1525	PROP DAM	CLEAR	SNOW	DAY
5	ANGLE	1	30	91	1722	INJURY	SNOW	SNOW	DAY
6	ANGLE	12	16	91	1455	PROP DAM	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
2	1988	#INJ ACC	1	
1	1989	#FAT ACC	0	
1	1990	#PDO ACC	5	
2	1991	PERSON =	1	*
6	TOTAL	NIGHTIME	0%	

TYPES	NUMBER	ROAD	
ANGLE	6	DRY	33%
REAR END	0	WET	0%
SIDESWIPE	0	SNOW	33%
LEFT TRN	0	ICE	33%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

SIXTH AVENUE WEST

Looking South

Looking East

FIFTH STREET

Looking West

TRAFFIC OPERATIONS

Fifth Street is a local east-west street and Sixth Avenue West is a local north-south street. Their intersection is in the middle residential area just north and west of Kalispell High School. This intersection is heavily influenced by high school traffic and parking. Both streets have tree lined boulevards with large deciduous trees located mostly in the corners of the intersection. Parking is allowed on both sides of the street and demand for parking appears to be extremely high when school is in session. Fifth street does not have curb & gutter and there are no sidewalks on the north side of the street. Traffic volumes on Third Avenue are very low, while Eighth Street has about double the volume at 600 vehicles per day.

Narrow street rights-of-way and extremely close building setbacks at this intersection do not provide adequate sight distance for an uncontrolled intersection. Sight distance was the most obscured in the northeast corner. Trees with low hanging branches also provide a significant loss of sight distance. Large tree trunks cause a temporary loss of sight distance which can sometimes be more troublesome than larger, more imposing obstructions. Street surfaces are rough and the streets have a high crown section with big dips at the corners.

Traffic volumes at this intersection were so low that it was difficult to determine any clearly defined operating patterns. However, it was observed that when school was released in the afternoon, a flurry of activity occurred for about 15 minutes. Their were people walking in the roadway to vehicles parked along the street and other vehicles raising dust throughout the area. Approximately 14 out of 22 northbound thru movements were students during this 15 minute period.

There were 6 angle accidents reported during the four year period that this study encompassed. The majority of accidents involved the southbound and westbound movements. Road conditions were significant at this site since 66% of the accidents occurred on a snowy or icy street surfaces. There were no night time accidents. Most of the accidents occurred between the hours of 3 PM and 5 PM. Only one accident occurred during the summertime.

IMPROVEMENTS

The apparent conditions contributing to accidents at this location are sight obstructions caused by low growing trees, houses and parked vehicles. Since sight restrictions which exist at this intersection are permanent, it would not be appropriate to install yield signs. Therefore, it is recommended that stop signs be installed on the minor street, Sixth Avenue. Parking restriction signs and curb markings, where possible, should be implemented to allow adequate sight distance form the stopped approach. The improvement sketch indicates the required parking setbacks, as determined by dynamic vehicle modeling of the required sight distances.

Long term improvements at this site would include construction of curb/gutter and sidewalk on Fifth Street and elimination of dips in the corners of the intersection. This work would most likely take the form of a special improvement district or some other funding source related to pedestrian safety.

SIXTH AVE. W & FIFTH ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	300
SOUTH APP	300
EAST APP	600
WEST APP	600

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	
WARNING	
CONSTRUCT	

ESTIMATED COST:

TOTAL	$1,030
MDoT FUND	$830
CITY FUND	$200

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.5	50%
PDO	2.5	50%

BENEFIT/COST RATIO: 10

	INDEX VALUE	SITE RANK
# ACCIDENTS	54	23
ACCIDENT RATE	77	4
SEVERITY	43	18
VOL/CAPACITY	15	19
SIGHT DIST.	72	17
DRIVER EXPECT	58	16
INFO DEFICIENT	58	16
HAZARD INDEX	56	15
B/C RATIO	50	11

PRIORITY	54.02	12

SITE

NUMBER

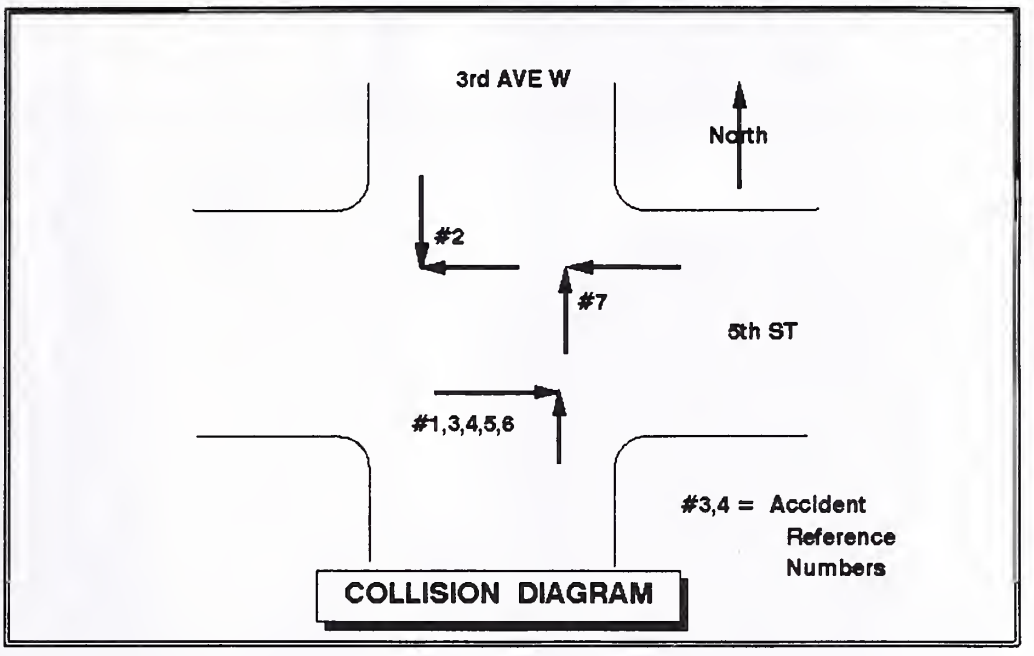
13

THIRD AVENUE WEST

and

FIFTH STREET

ACCIDENT SUMMARY
THIRD AVE. W & FIFTH ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	9	1	88	1215	PROP DAM	CLEAR	DRY	DAY
2	ANGLE	2	20	89	1112	PROP DAM	CLEAR	ICY	DAY
3	ANGLE	5	23	89	835	PROP DAM	RAIN	WET	DAY
4	ANGLE	6	5	89	1524	PROP DAM	CLEAR	DRY	DAY
5	ANGLE	3	26	91	1205	INJURY	CLEAR	ICY	DAY
6	ANGLE	11	4	91	1054	INJURY	SNOW	ICY	DAY
7	ANGLE	12	17	91	1737	INJURY	CLEAR	ICY	NITE

ACCIDENT STATISTICS

NO. ACC.	YEAR			
1	1988	#INJ ACC	3	
3	1989	#FAT ACC	0	
0	1990	#PDO ACC	4	
3	1991	PERSON =	3	*
7	TOTAL	NIGHTIME	14%	

TYPES	NUMBER	ROAD	
ANGLE	7	DRY	29%
REAR END	0	WET	14%
SIDESWIPE	0	SNOW	0%
LEFT TRN	0	ICE	57%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

THIRD AVENUE WEST

Looking South

Looking East

FIFTH STREET

Looking West

TRAFFIC OPERATIONS

Fifth Street is a local east-west street and Third Avenue West is a local north-south street. Their intersection is in the middle of a residential area with the Elrod Elementary School being located in the northwest corner of this intersection. Another study site is located on Fifth Street, one block east. The area is an older neighborhood and curb/gutter, sidewalks and boulevard are all mature. Both streets have tree lined boulevards with large deciduous trees. Parking is restricted at three of the corners and entirely prohibited during school days on the north side of Fifth, adjacent to the school. Demand for parking appears to be moderate to high. Traffic volumes on Third Avenue are low, while Fifth Street is more than double at 1400 ADT.

Sight distance is especially bad in all corners of this intersection due to houses and dense, low branches on trees. Narrow street right-of-way and inadequate building setbacks at this intersection cause intrusion of permanent obstructions within the sight triangle required for uncontrolled intersections. Large tree trunks also cause a temporary loss of sight distance which can sometimes be more troublesome than larger, more imposing obstructions. Street surface are smooth and uniform in the east-west direction and very rough in the north-south direction.

Traffic control consists of no parking signs, an advance school sign and a crosswalk on the west side of the intersection. There is no crosswalk sign at the cross walk.

Driver behavior at this intersection indicates a predominant assumption of right-of-way by east-west drivers and the majority of north-south drivers actually stop at the intersection.

There were 7 angle accidents reported during the four year period that this study encompassed. Five of the seven accidents involved northbound and eastbound vehicles. Road conditions were significant at this site since 57% of the accidents occurred on a snowy or icy street surfaces. There was one night time accident. Almost all of the accidents occurred between the hours of 10 AM and 3 PM. None of the accidents occurred in the summer months.

IMPROVEMENTS

Since permanent sight restrictions exist in most corners of this intersection and there is sufficient evidence that it cannot function reasonably well as an uncontrolled intersection, vehicle right-of-way control is indicated. Yield signs cannot be used because yield signs require the same unobtrusive line of sight that is necessary for uncontrolled intersections. Therefore, stop sign control is recommended for the lesser volume, Third Avenue West. There are stop signs at the intersections both north and south of this location and from observations, it appears that vehicles expect to slow or stop in the north and south directions.

Pedestrian traffic at this intersection is higher than an other area intersections, even without school children. Since stop signs will be installed on Third Avenue, it is also recommended that cross walks be installed on all legs of the intersection. Because of the wide boulevards, it is recommended that the corner sidewalks be reconstructed to allow vehicles to stop nearer to the cross street without infringing on the crosswalks. This will also direct pedestrians to the corner at a point where they will be more visible to approaching traffic.

The existing school crossing traffic control does not comply with MUTCD. The advance x-ing sign must also be accompanied by a school crossing sign, at the crossing. These signs should be installed in both directions on Fifth. The signs would not be necessary on Third because MUTCD states that school crossing signs should not be installed with stop signs present.

New parking restrictions, as shown in the improvement sketch, are critical to clear up the line of sight at this intersection. Yellow curbs should be painted in the intersection area to reduce the possibility of vehicles parking too close to the intersection.

New standard street name signs should also be installed to replace the existing black and white non-reflective signs.

Long term improvements do not appear to be applicable to the conditions encountered at this site.

THIRD AVE. W & FIFTH ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	450
SOUTH APP	600
EAST APP	1400
WEST APP	1400

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	YES
MARKING	YES
WARNING	YES
REGULATORY	

ESTIMATED COST:

TOTAL	$3,540
MDoT FUND	$2,145
CITY FUND	$1,395

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	1.8	60%
PDO	2.4	60%

BENEFIT/COST RATIO: 9

	INDEX VALUE	SITE RANK
# ACCIDENTS	58	19
ACCIDENT RATE	49	11
SEVERITY	52	5
VOL/CAPACITY	15	20
SIGHT DIST.	48	22
DRIVER EXPECT	58	20
INFO DEFICIENT	100	1
HAZARD INDEX	55.2	17
B/C RATIO	49	12

PRIORITY	53.15	13

SITE

NUMBER

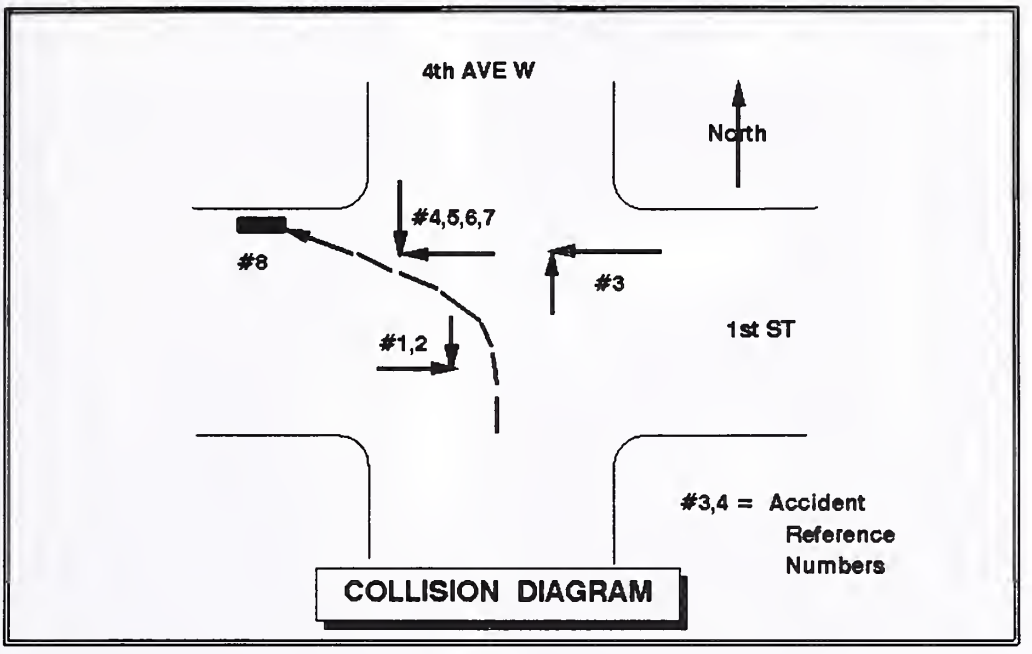
14

FOURTH AVENUE WEST

and

FIRST STREET

ACCIDENT SUMMARY
FOURTH AVE. W & FIRST ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	2	3	88	1103	PROP DAM	CLEAR	SNOW	DAY
2	ANGLE	5	8	88	1700	PROP DAM	RAIN	WET	DAY
3	ANGLE	6	7	88	1252	PROP DAM	CLEAR	DRY	DAY
4	ANGLE	9	17	88	1023	PROP DAM	RAIN	WET	DAY
5	ANGLE	12	27	88	1642	PROP DAM	CLEAR	ICY	DAY
6	ANGLE	5	4	89	803	INJURY	CLEAR	DRY	DAY
7	ANGLE	7	26	91	1400	PROP DAM	CLEAR	DRY	DAY
8	PARKED VEH	12	6	88	1527	PROP DAM	CLEAR	SNOW	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
6	1988	#INJ ACC	2	
1	1989	#FAT ACC	0	
0	1990	#PDO ACC	6	
1	1991	PERSON =	2	*
8	TOTAL	NIGHTIME	0%	

TYPES	NUMBER	ROAD	
ANGLE	7	DRY	38%
REAR END	0	WET	25%
SIDESWIPE	0	SNOW	25%
LEFT TRN	0	ICE	13%
OTHER	1	OTHER	0%

*** No. of Persons Injured**

Looking North

FOURTH AVENUE WEST

Looking South

Looking East

FIRST STREET

Looking West

TRAFFIC OPERATIONS

First Street is a local east-west street and Fourth Avenue West is a local north-south street. Their intersection is in the middle of a residential area just one block south of Center Street, a major east-west arterial. Fourth Avenue, at Center Street, is a major access to the Center Mall and that intersection is also a study site.

This intersection is not heavily influenced by the access to Center Mall, but it is apparent from the newer construction on Fourth Avenue north of First, that improvements were made to that street as part of the Mall development. All other approach legs of this intersection are deteriorating and have very rough surfaces. There are jogs in the curb line at the intersection radius points which is disorienting to turning vehicles. Both streets have tree lined boulevards with large deciduous trees. There are bushes and a house in the northwest corner which creates very limited sight distance. There are narrow street rights-of-way and building setbacks in at least three corners, obstruct sight distance to the extent that it is insufficient for an uncontrolled intersection. Parking is allowed on both sides of the street and demand for parking appears to be moderate. Traffic volumes on Fourth Avenue are low, while First Street Street has more than double the volume at 1400 vehicles per day.

Vehicles observed were traveling at a higher speed on First than on Fourth. East-west drivers also assume the right-of-way while north-south drivers enter the intersection with some trepidation.

There were 7 angle accidents reported during the four year period that this study encompassed. One other accident occurred that involved a car parked near the northwest corner. There were two other sideswipe accidents on Fourth Avenue north of the intersection, but it was difficult to tell from the reports whether they were related to this intersection in any way. Four of the seven angle accidents involved southbound and westbound vehicles. Road conditions were significant at this site since 38% of the accidents occurred on snowy or icy street surfaces. There were no night time accidents. There was no prevalent time of the day that accidents occurred and none of them occurred during the summer months.

IMPROVEMENTS

It is apparent that this intersection cannot function as an uncontrolled intersection. Since there are permanent sight obstructions, yield signs are not an appropriate control. Therefore, stop signs are the recommended control at this location. The stop signs should be installed on Fourth Avenue West, the minor leg. Even without permanent sight obstructions, traffic volumes on the intersecting streets are approaching a degree of disparity that would create the need for traffic control.

Parking restrictions would be required at the intersection corners to provide unimpeded sight distance for vehicles approaching and leaving the stop signs. Those restrictions are indicated on the improvement sketch. In order to eliminate jogged radii in the corners, which tend to mislead drivers turning at the intersection, it is recommended that the radii be replaced with new curb & gutter sections. The sidewalks should then be realigned toward the middle of the new radii which will negate the effect of wide boulevards; allow vehicles to stop closer to the cross road; and improve pedestrian-vehicle visibility.

Long term improvements at this site should include resurfacing of the street, since it is possible that errant vehicle maneuvers may relate to the extreme roughness and potholes in the street.

FOURTH AVE. W & FIRST ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	550
SOUTH APP	850
EAST APP	1400
WEST APP	1200

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	YES
MARKING	
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$4,000
MDoT FUND	$1,090
CITY FUND	$2,910

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.6	60%
PDO	3.7	54%

BENEFIT/COST RATIO: 11

	INDEX VALUE	SITE RANK
# ACCIDENTS	61	16
ACCIDENT RATE	53	9
SEVERITY	46	13
VOL/CAPACITY	16	17
SIGHT DIST.	59	20
DRIVER EXPECT	58	17
INFO DEFICIENT	67	14
HAZARD INDEX	52.5	22
B/C RATIO	52	9

PRIORITY	52.34	14

SITE

NUMBER

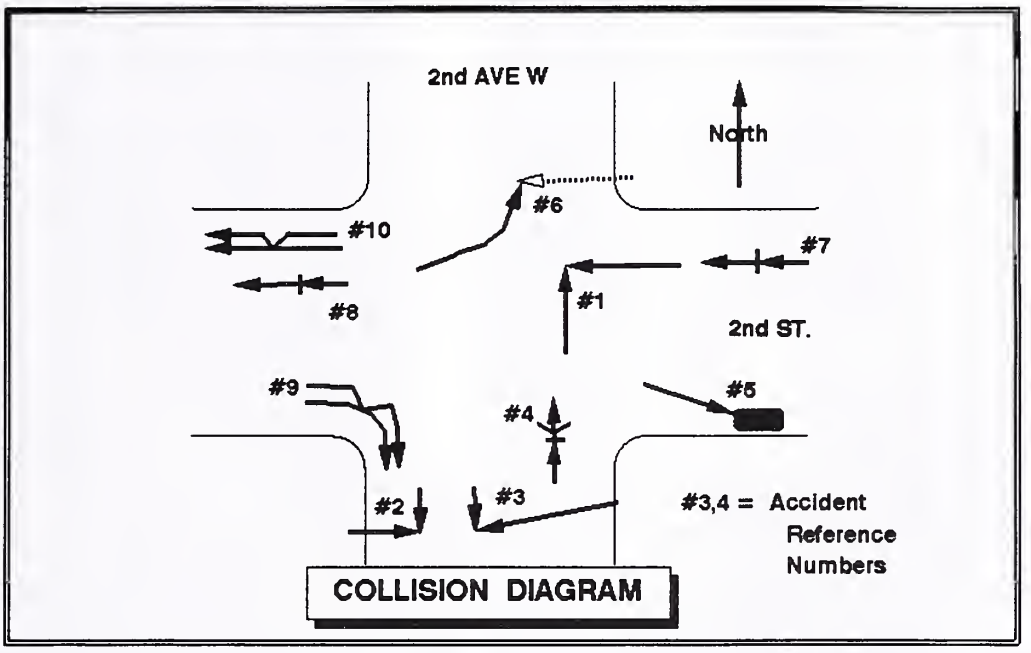
15

SECOND AVENUE WEST

and

SECOND STREET

ACCIDENT SUMMARY
SECOND AVE. W & SECOND ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	11	14	88	1440	PROP DAM	RAIN	WET	DAY
2	ANGLE	8	7	90	932	INJURY	CLEAR	DRY	DAY
3	ANGLE	8	31	90	1301	PROP DAM	CLEAR	DRY	DAY
4	BACKING	4	2	91	1145	PROP DAM	CLEAR	DRY	DAY
5	PARKED VEH	6	8	89	1023	INJURY	CLEAR	DRY	DAY
6	PEDESTRIAN	12	3	91	2104	INJURY	CLEAR	DRY	NITE
7	REAREND	8	19	88	1453	PROP DAM	CLEAR	DRY	DAY
8	REAREND	2	3	89	1233	INJURY	CLEAR	SNOW	DAY
9	SIDESWIPE	5	8	89	854	PROP DAM	CLEAR	DRY	DAY
10	SIDESWIPE	7	25	91	1630	PROP DAM	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR		
2	1988	#INJ ACC	4
3	1989	#FAT ACC	0
2	1990	#PDO ACC	6
3	1991	PERSON =	5 *
10	TOTAL	NIGHTIME	10%

TYPES	NUMBER	ROAD	
ANGLE	3	DRY	89%
REAR END	2	WET	0%
SIDESWIPE	2	SNOW	0%
LEFT TRN	0	ICE	11%
OTHER	3	OTHER	0%

*** No. of Persons Injured**

Looking North

SECOND AVENUE WEST

Looking South

Looking East

SECOND STREET

Looking West

TRAFFIC OPERATIONS

Second Street is a local east-west street and Second Avenue West is a local north-south street. Their intersection is on the western edge of the Central Business District. The intersection is surrounded by businesses and parking lots. A building in the southwest corner is located right on property line at the back of the sidewalk.

This intersection currently operates as a four way stop. Appropriate stop signs are located on all of the approaches. The eastbound stop sign is damaged. There are numerous parking restriction signs surrounding the intersection. There are also yellow curb marks near the corners. In all but one case, the parking restrictions do not comply with distances specified by state law. parking demand is moderate to heavy at various times during the day.

Traffic volumes on the intersection approaches range from 2500 to 4600 ADT. There is an average number of turning vehicles and a significant number of pedestrians crossing at this intersection.

The most obvious problem observed at this intersection was drivers not being uncertain of who is supposed to stop. The stop signs do have the 4-way sign plates, but these signs are commonly not noticed by the average driver. Another problem relates to sight obstructions and traffic clutter caused by vehicles parked too close to the intersection. When campers are parked at the right location, stop signs are hidden and pedestrians cannot be seen stepping off the curb.

The collision diagram, shown on page 15-1, indicates that there were various types of accidents occurring at this intersection. There were ten total accidents during the four year study period. One pedestrian accident displayed typical characteristic of four way stop intersections when significant pedestrian movements are present. Four-way stop intersections typically fill the driver's task load. In addition to controlling the vehicle during deceleration and acceleration, the driver must scan in three different directions and determine the real intent of three different drivers who could be involved in at least seven different conflicts. Complex decisions also enter into the drivers work load, since he must determine who arrived first, who went last and who should go next. Many times he must also mediate differences in opinion of

who should do what next, while doing a vehicular version of the rumba. Throw in any additional diversion and the driver experiences an overload condition. Thus, pedestrians are simply not seen. Even when four way stop intersections are not congested, most drivers do not know what to do about pedestrians crossing the street when its their turn to go.

Rearend and sideswipe accidents at this intersection are related to parking maneuvers near the corners. Only one angle accident occurred in the intersection. The other two involved vehicles exiting drive approaches. Most of the accident occurred on clear dry roads at various times of the day and months of the year. Only one accident occurred at night.

IMPROVEMENTS

Warrants for a four way stop at this intersection are marginal. Alternatives were considered and it was determined that the accident rate was not sufficient enough to warrant a change which may actually increase some accidents initially. Recommended improvements therefor, focus on cleaning up intersection clutter and providing additional information regarding the four way stop condition. Recommended parking restrictions are denoted on the improvement sketch. New stop bars and crosswalk markings are proposed to provide visual clues to the driver that all legs of the intersection must stop. The cross walk marks may also encourage pedestrian crossings in a straight line within the intersection and may give the driver a subtle warning that pedestrians are one more conflict that he must consider while navigating through the intersection.

If vehicular or pedestrian traffic were to increase by approximately 30%, a traffic signal would be within the minimum volume warrant range. Predicting a certain time when a signal would be warranted at this location is difficult, since traffic volume history at this location does not reveal any clear trends. Any other long term improvements at this site are difficult to predict.

SECOND AVE. W & SECOND ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	2500
SOUTH APP	3800
EAST APP	4600
WEST APP	3800

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	YES
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$2,185
MDoT FUND	$1,895
CITY FUND	$290

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.8	20%
PDO	0.9	15%

BENEFIT/COST RATIO: 7

	INDEX VALUE	SITE RANK
# ACCIDENTS	67	9
ACCIDENT RATE	23	17
SEVERITY	55	4
VOL/CAPACITY	70	4
SIGHT DIST.	100	4
DRIVER EXPECT	75	9
INFO DEFICIENT	54	24
HAZARD INDEX	57	14
B/C RATIO	41	16

PRIORITY	51.72	15

SITE

NUMBER

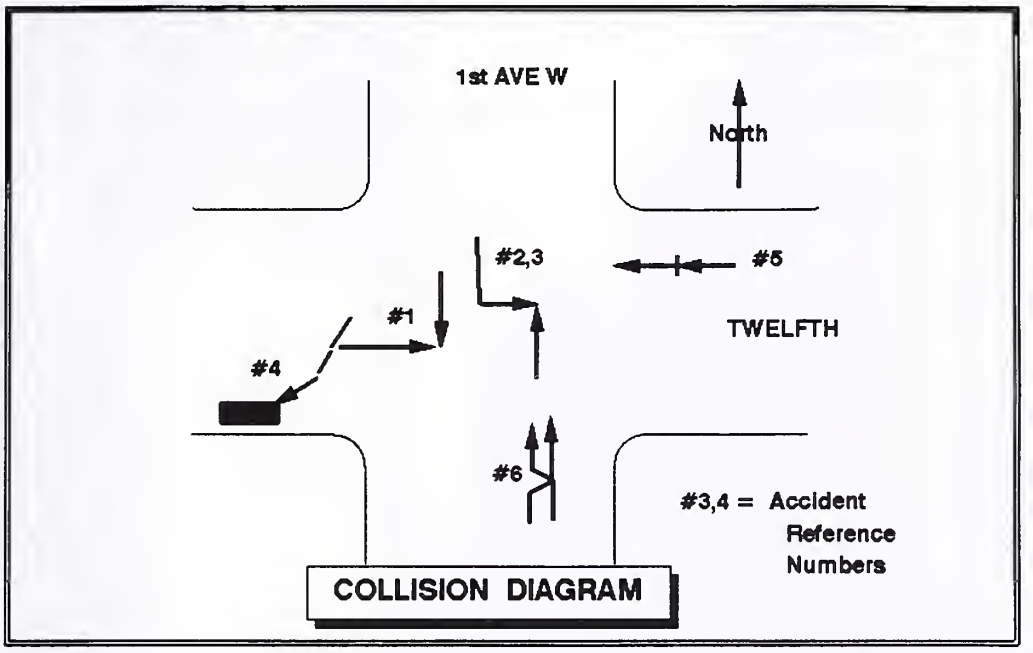
16

FIRST AVENUE WEST

and

TWELFTH STREET

ACCIDENT SUMMARY
FIRST AVE. W & TWELFTH



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	11	5	90	1703	PROP DAM	RAIN	WET	DAY
2	LEFT TURN	3	4	88	850	INJURY	CLEAR	DRY	DAY
3	LEFT TURN	5	15	90	1210	PROP DAM	CLEAR	DRY	DAY
4	PARKED VEH	10	23	90	2020	PROP DAM	CLEAR	DRY	NITE
5	REAREND	1	10	89	1410	PROP DAM	SNOW	SNOW	DAY
6	SIDESWIPE	10	26	90	2108	INJURY	CLEAR	DRY	NITE

ACCIDENT STATISTICS

NO. ACC.	YEAR			
1	1988	#INJ ACC	3	
1	1989	#FAT ACC	0	
4	1990	#PDO ACC	3	
0	1991	PERSON =	4	*
6	TOTAL	NIGHTIME	33%	

TYPES	NUMBER	ROAD	
ANGLE	1	DRY	67%
REAR END	1	WET	17%
SIDESWIPE	1	SNOW	17%
LEFT TRN	2	ICE	0%
OTHER	1	OTHER	0%

*** No. of Persons Injured**

Looking North

FIRST AVENUE WEST

Looking South

Looking East

TWELFTH STREET

Looking West

TRAFFIC OPERATIONS

First Avenue West is a Federal Aid Urban Street which is west of and parallel to Main Street (US 93). Twelfth Street is one block south of the southern end of the FAU designation on First and serves as a major access between Main and First. Even though their intersection is in the middle residential area, there are high traffic volumes entering this intersection. The major traffic flow is in the north-south direction, but there are heavy southbound left turn and westbound right turn movements because of the access to Main Street, one block east.

Both streets have tree lined boulevards with large deciduous trees. Parking is allowed on both sides of the street and demand for parking appears to be light. Parking restrictions at the corners are not marked. The existing intersection is controlled by stop signs on Twelfth Street and there is a double yellow centerline on First Avenue. The stop signs, (eastbound hidden by a tree) are minimum size and located at inconsistent locations. There are no indications on the Twelfth Street approaches, other than the stop signs, that First Avenue is a major traffic carrying street.

Traffic observations indicate that the intersection becomes fairly congested at certain times of the day and heavy left turn movements from the southbound direction contribute to that condition. The left turn movements also creates conflicts since vehicles stopped in the traffic lane, waiting to turn left, block the line of sight from the side street while Second Ave. thru traffic tends to pass on the right, when there is room. Because of congestion, Twelfth Street traffic backs up on the westbound approach. Thru and left turning vehicles tend to pull along side right turning traffic on the westbound approach thereby blocking the line of sight for both vehicles. All of these problems are complicated by the intermittent sight restrictions caused by tree trunks and occasional vehicles parked near the intersection.

There is also a sharp horizontal curve approximately 300 feet south of the intersection. Even though this curve does not prevent adequate sight distance of oncoming vehicles, vehicle speeds are fast enough (85th percentile = 35 mph) in the northbound direction to cause some discomfort on that approach to the intersection and the significance of the intersection is somewhat unexpected.

There were 6 accidents at this intersection during the four year period that this study encompassed. Road conditions were not a significant factor at this site since only 17% of the accidents occurred on a snowy or icy street surfaces. Night time accidents were significant with 33% of the total. Various types of accidents were reported. Left turn and sideswipe accidents were related to heavy left turning movements, while angle and rearend accidents were related to both sight distance obstructions and left turning vehicles.

IMPROVEMENTS

The apparent conditions contributing to accidents at this location are high traffic volumes and heavy turning movements at a location with no traffic control provisions adequate for the traffic conditions. The primary recommended improvement would focus on efficiency which will necessarily improve safety. Left turn bays should be marked on First Avenue West and necessary parking restrictions be implemented to effect the new lane designations. The turn lane designations should match the same recommendations being proposed at the Eleventh Street intersection, one block north. The new left turn lanes will alert First Avenue drivers to the fact that they are approaching an intersection different than previous intersections encountered. They will also provide a defined location for storing left turn vehicles while providing side street traffic a line of sight and the knowledge that thru traffic is unimpeded by the stored vehicle. The turn lanes also have the benefit of eliminating parking for a significant distance on either side of the intersection, which will eliminate occasional sight obstructions. Six of the angle accidents clearly involved drivers who had stopped for the signs, but still pulled out into the path of oncoming traffic.

To reduce the frequency of vehicles who do not stop for the signs, it is recommended that trees be trimmed and the signs be relocated closer to the intersection. Marking of a centerline and stop bars on Twelfth will provide additional emphasis on the stop condition.

Long Term Improvements at this site should be implemented when traffic volumes on First Avenue increase by approximately 15% and extensive efficiency improvements are required. The corridor section of this report

indicates that a continuous left turn lane should be considered with these circumstances. In that case, signing and pavement markings on First could be modified to accommodate the long term solution. Significant volume increases on First may also warrant signalization of this intersection. All recommendations at this site should be reviewed with the benefit of proposed actions that may be included in the new transportation plan.

FIRST AVE. W & TWELFTH ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	4600
SOUTH APP	2500
EAST APP	2400
WEST APP	400

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	YES
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$3,095
MDoT FUND	$2,945
CITY FUND	$150

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.8	45%
PDO	2.0	50%

BENEFIT/COST RATIO: 7

	INDEX VALUE	SITE RANK
# ACCIDENTS	54	22
ACCIDENT RATE	21	20
SEVERITY	60	2
VOL/CAPACITY	36	12
SIGHT DIST.	100	12
DRIVER EXPECT	67	12
INFO DEFICIENT	71	10
HAZARD INDEX	53.3	21
B/C RATIO	44	14

PRIORITY	50.23	16

SITE

NUMBER

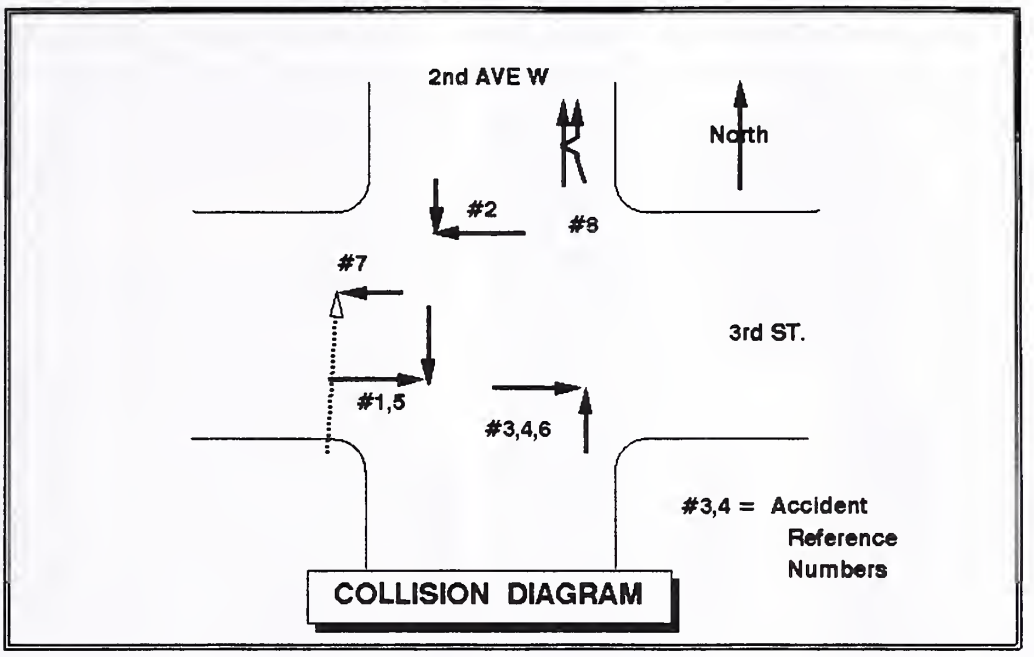
17

SECOND AVENUE WEST

and

THIRD STREET

ACCIDENT SUMMARY
SECOND AVE. W & THIRD ST.



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	12	30	88	1501	PROP DAM	SNOW	ICY	DAY
2	ANGLE	8	8	89	1627	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	12	14	89	1601	PROP DAM	SNOW	SNOW	DAY
4	ANGLE	10	9	90	750	PROP DAM	SNOW	DRY	DAY
5	ANGLE	11	16	90	1655	PROP DAM	CLEAR	DRY	DAY
6	ANGLE	5	20	91	1522	PROP DAM	CLEAR	DRY	DAY
7	PEDESTRIAN	10	5	90	1850	INJURY	CLEAR	DRY	DAY
8	SIDESWIPE	9	28	91	1135	PROP DAM	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
1	1988	#INJ ACC	1	
2	1989	#FAT ACC	0	
3	1990	#PDO ACC	7	
2	1991	PERSON =	1	*
8	TOTAL	NIGHTIME	0%	

TYPES	NUMBER	ROAD	
ANGLE	6	DRY	75%
REAR END	0	WET	0%
SIDESWIPE	1	SNOW	13%
LEFT TRN	0	ICE	13%
OTHER	1	OTHER	0%

*** No. of Persons Injured**

Looking North

SECOND AVENUE WEST

Looking South

Looking East

THIRD STREET

Looking West

TRAFFIC OPERATIONS

Third Street is a local east-west street and Second Avenue West is a local north-south street. Their intersection is within the confines of the Central Business District. There are businesses in the south half of the intersection and in the northwest corner; and a parking lot in the northeast corner. The intersection is controlled by stop signs on Second Avenue West. Double yellow centerlines are marked on both streets. Parking restrictions are marked at the corner with yellow curb paint and there are numerous 2 hour parking signs near the intersection. The parking restrictions are not adequate for conditions encountered and do not fully comply with distances specified by state law. Parking demand is moderate to heavy depending on the time of day.

Traffic volumes on First Avenue West are almost the same on the north and east legs of the intersection, while the south leg has less traffic, but almost double that on the west leg. From ADT's and turning movement volumes, it is apparent that Second is actually the major volume street. The westbound right turn is actually the heaviest traveled movement at this intersection. This fact can actually be seen in the street's pavement wear.

The most obvious operational condition at this intersection involves a situation where most drivers are not quite sure who is supposed to stop at the intersection. Site distances in all corners of the intersection are very limited and most drivers approach with trepidation. Initial investigations at this intersection resulted in a feeling that the wrong direction was required to stop. Stop signs on Third are minimum size and sometimes blend in with other street hardware and with buildings and signs in the background.

There were 6 angle accidents, 1 pedestrian accident and a sideswipe accident at this location during the four year period that this study encompassed. Only two of the angle accident reports indicated that the vehicles had stopped before entering the intersection. Road conditions were not a significant factor at this site since only 26% of the accidents occurred on a snowy or icy street surfaces. There were no night time accidents. Most of the accidents occurred between 3 PM and 5 PM, which would be near peak hour volumes in the downtown area.

IMPROVEMENTS

The most notable traffic control problem at this intersection is the location of stop signs on the major traffic legs of the intersection. Since turning movements on the westbound leg are right turns those vehicles should be able to clear with the least number of conflicts. Pedestrian movements are not heavy nor concentrated in any particular direction. There should be no reason why the major thru traffic flow should be required to stop.

It has been found that intersections which require the major street to stop have a higher accident rates than those which stop the minor leg. The reason is because drivers are creatures of habit. When a certain experience is repeated many times, drivers learn and store that information so that driving reactions become ingrained. Drivers approaching an intersection which requires a stop with never a conflicting vehicle in sight, develops a pattern of disregard for potential conflicts. After a period of time, the habit is ingrained and the subconscious mind completely blocks out the stop condition. Running the stop sign becomes an automatic behavior which reduces the driving task and lets the drivers cognitive abilities react only to perceived hazards. In this case, where buildings are close to the corner and completely inadequate sight distance exists and there is inadequate time for reaction, subconscious control can be dangerous.

Because of this, it is recommended that the existing stop signs be removed and new, larger stop signs be installed on Third Street. The new stop condition should be reinforced by marking stop bars and crosswalks. These will visually inform drivers on First that they must stop and Second Avenue West traffic is not required to stop. In addition, parking restrictions should be marked with yellow curb paint and signing, as indicated in the improvement sketch. It may also be desirable to position portable stop ahead signs at mid-block for a few weeks after the changes are implemented to recondition drivers to the change in operation.

In addition, westbound right turn movements could clear the intersection faster and with errant movements if the corner inlet was not depressed so deep.

The improvement sketch also indicates that the inlet should be raised and a section of pavement replaced to provide a more uniform surface for that approach.

Long term improvements do not appear to be applicable to the conditions encountered at this site.

SECOND AVE. W & THIRD ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	2800
SOUTH APP	1600
EAST APP	2500
WEST APP	800

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	YES
MARKING	YES
WARNING	
CONSTRUCT	YES

ESTIMATED COST:

TOTAL	$5,307
MDoT FUND	$2,007
CITY FUND	$3,300

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.4	40%
PDO	3.2	45%

BENEFIT/COST RATIO: 3

	INDEX VALUE	SITE RANK
# ACCIDENTS	61	17
ACCIDENT RATE	33	16
SEVERITY	41	21
VOL/CAPACITY	42	11
SIGHT DIST.	100	7
DRIVER EXPECT	82	4
INFO DEFICIENT	75	8
HAZARD INDEX	58.2	12
B/C RATIO	27	17

PRIORITY	47.9	17

SITE

NUMBER

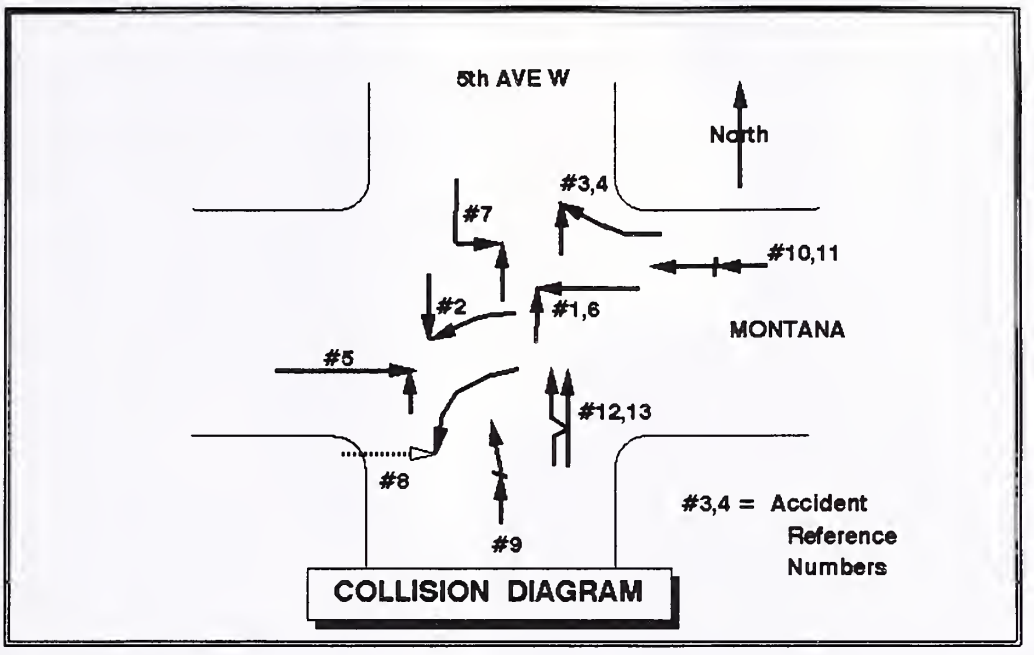
18

FIFTH AVENUE WEST

and

MONTANA

ACCIDENT SUMMARY
FIFTH AVE. W & MONTANA



ACCIDENT KEY

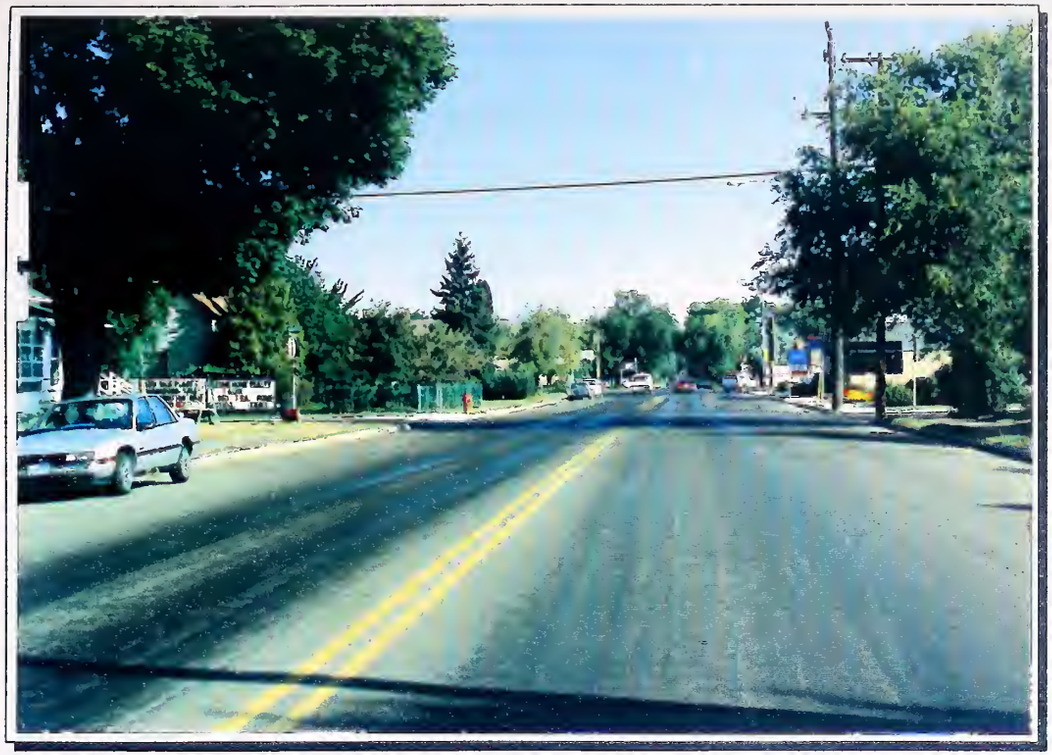
ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	12	23	88	932	PROP DAM	CLEAR	ICY	DAY
2	ANGLE	6	14	90	1130	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	9	24	90	1556	PROP DAM	CLEAR	DRY	DAY
4	ANGLE	12	21	90	1545	PROP DAM	CLEAR	ICY	DAY
5	ANGLE	5	12	91	1505	PROP DAM	RAIN	WET	DAY
6	ANGLE	11	26	91	1255	PROP DAM	RAIN	WET	DAY
7	LEFT TURN	12	1	90	1750	PROP DAM	SNOW	ICY	NITE
8	PEDESTRIAN	11	7	88	1208	INJURY	CLEAR	DRY	DAY
9	REAREND	11	24	89	1716	INJURY	CLEAR	ICY	NITE
10	REAREND	2	20	90	1045	INJURY	CLEAR	ICY	DAY
11	REAREND	1	29	91	1255	PROP DAM	CLEAR	ICY	DAY
12	SIDESWIPE	12	8	89	555	PROP DAM	SNOW	WET	NITE
13	SIDESWIPE	7	26	91	1220	PROP DAM	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR		
2	1988	#INJ ACC	2
2	1989	#FAT ACC	0
6	1990	#PDO ACC	11
3	1991	PERSON =	2 *
13	TOTAL	NIGHTIME	23%

TYPES	NUMBER	ROAD	
ANGLE	6	DRY	31%
REAR END	3	WET	23%
SIDESWIPE	2	SNOW	0%
LEFT TRN	1	ICE	46%
OTHER	1	OTHER	0%

*** No. of Persons Injured**



Looking North

FIFTH AVENUE WEST

Looking South

Looking East

MONTANA STREET

Looking West

TRAFFIC OPERATIONS

Fifth Avenue West is a Federal Aid Urban Street which is also a north-south arterial through Kalispell. Montana Street is a local east-west street which parallels Idaho Street, a major arterial. There are two other study sites on Montana within this corridor. The east half of the intersection has business and light industrial land use while the west side is a residential area.

The intersection has heavy traffic volumes with significant turning movements, especially the westbound right and the northbound left and right. There are centerline marks on Fifth and stop signs on Montana. Stop signs are visible on the approach, but the mounting height and location could be improved. Parking is allowed on both sides of the street except for the east side of Fifth, north of the intersection, which has total parking prohibition. Demand for parking appears to be light. Parking restrictions at the corners are not marked. The existing intersection is controlled by stop signs on Montana Street and there is a double yellow centerline on Fifth Avenue.

Traffic observations indicate that the intersection becomes fairly congested at certain times of the day and heavy left turn movements from the northbound direction contribute to that condition. The left turn movements also creates conflicts since vehicles stopped in the traffic lane waiting to turn left block the line of sight from the side street while Fifth Avenue thru traffic tends to pass on the right, when there is room. Because of congestion, Montana Street traffic backs up on the westbound approach. Thru and left turning vehicles tend to pull along side right turning traffic on the westbound approach thereby blocking the line of sight for both vehicles. All of these problems are complicated by the intermittent sight restrictions caused by tree trunks and occasional vehicles parked near the intersection.

There were 6 angle, 1 left turn, 1 pedestrian, 2 sideswipe and 1 rearend accident reported during the four year period that this study encompassed. Road conditions were a significant factor at this site since 46% of the accidents occurred on a snowy or icy street surfaces. There were 3 night time accident. Accidents appear to be clustered around peak noon and afternoon traffic periods. Most of the accidents occurred during November and December.

IMPROVEMENTS

The apparent conditions contributing to accidents at this location are high traffic volumes and heavy turning movements at a location where traffic control provisions are inadequate traffic conditions. The primary recommended improvement would focus on efficiency, which will necessarily improve safety. Left turn bays should be marked on Fifth Avenue West and necessary parking restrictions be implemented to effect the new lane designations.

The new left turn lanes will provide a defined location for storing left turn vehicles while providing side street traffic a line of sight and the knowledge that thru traffic is unimpeded by the stored vehicle. The turn lanes also have the benefit of eliminating parking for a significant distance on either side of the intersection, which will eliminate occasional sight obstructions. Almost all of the accidents at this intersection could be related to left turns and erratic movements while the intersection was congested.

To reduce the frequency of vehicles who may not stop for the signs, it is recommended that the existing stop signs be relocated at standard locations and parking in advance of the signs be restricted and marked. Marking of a centerline and stop bars on Montana will provide additional emphasis on the stop condition.

Long Term Improvements at this site should be implemented when traffic volumes increase by approximately 50% on Montana Street. At that time traffic signal warrants would be met. All recommendations at this site should be reviewed with the benefit of proposed actions that may be included in the new transportation plan.

FIFTH AVE. W & MONTANA ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	7300
SOUTH APP	8200
EAST APP	2200
WEST APP	1700

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	YES
WARNING	
CONSTRUCT	

ESTIMATED COST:

TOTAL	$4,494
MDoT FUND	$4,194
CITY FUND	$300

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.9	30%
PDO	4.8	40%

BENEFIT/COST RATIO: 3

	INDEX VALUE	SITE RANK
# ACCIDENTS	74	4
ACCIDENT RATE	23	18
SEVERITY	42	19
VOL/CAPACITY	69	5
SIGHT DIST.	100	8
DRIVER EXPECT	67	11
INFO DEFICIENT	67	12
HAZARD INDEX	55.9	16
B/C RATIO	25	18

PRIORITY	45.7	18

SITE

NUMBER

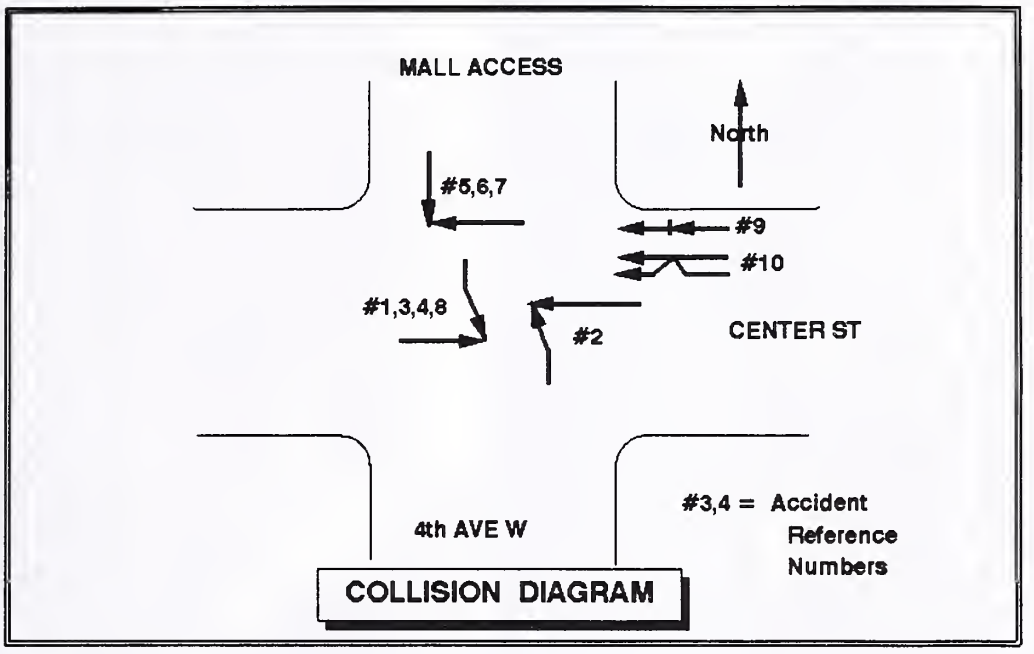
19

FOURTH AVENUE WEST

and

CENTER STREET

ACCIDENT SUMMARY
FOURTH AVE. W & CENTER ST.



ACC NO.	ACCIDENT TYPE	ACCIDENT KEY MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	5	5	88	1400	PROP DAM	CLEAR	DRY	DAY
2	ANGLE	6	1	88	1558	PROP DAM	RAIN	WET	DAY
3	ANGLE	8	2	88	1409	PROP DAM	CLEAR	DRY	DAY
4	ANGLE	11	17	89	855	PROP DAM	CLEAR	DRY	DAY
5	ANGLE	4	17	90	1315	PROP DAM	CLEAR	DRY	DAY
6	ANGLE	8	25	90	1658	PROP DAM	CLEAR	DRY	DAY
7	ANGLE	10	21	91	1138	PROP DAM	CLEAR	DRY	DAY
8	ANGLE	11	15	91	1500	INJURY	CLEAR	DRY	DAY
9	REAREND	1	17	89	926	PROP DAM	CLEAR	ICY	DAY
10	SIDESWIPE	12	8	90	1336	PROP DAM	CLEAR	DRY	DAY

ACCIDENT STATISTICS

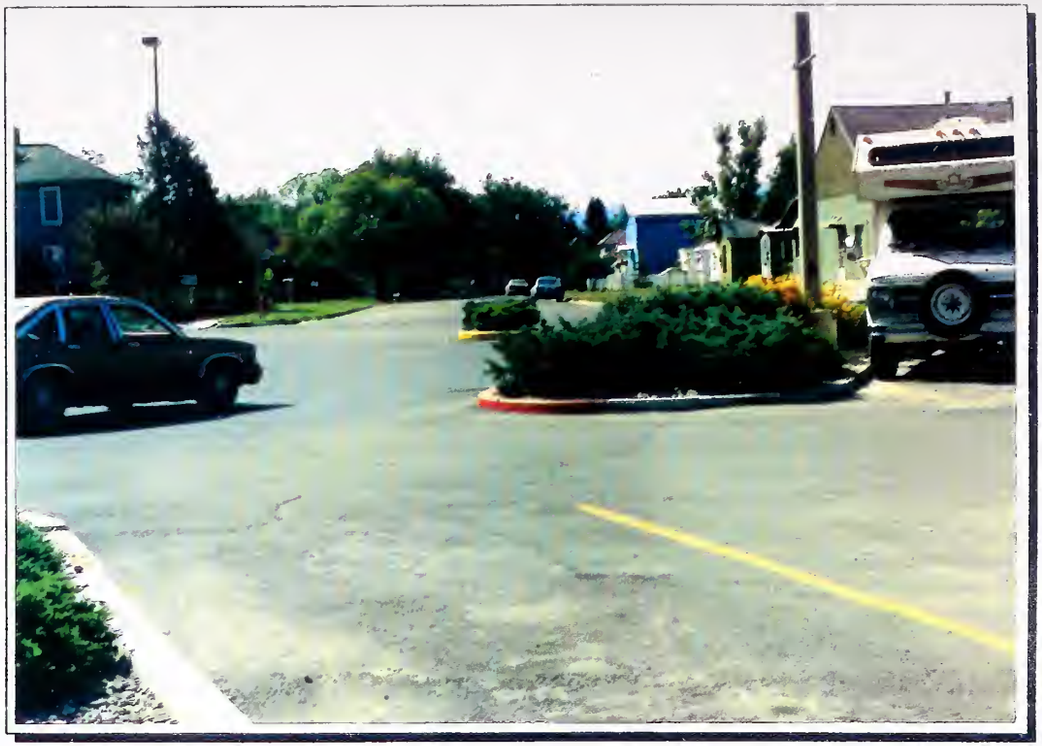
NO. ACC.	YEAR			
3	1988	#INJ ACC	1	
2	1989	#FAT ACC	0	
3	1990	#PDO ACC	9	
2	1991	PERSON =	1	*
10	TOTAL	NIGHTIME	0%	

TYPES	NUMBER	ROAD	
ANGLE	8	DRY	80%
REAR END	1	WET	10%
SIDESWIPE	1	SNOW	0%
LEFT TRN	0	ICE	10%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

FOURTH AVENUE WEST



Looking South

Looking East

CENTER STREET

Looking West

TRAFFIC OPERATIONS

Fourth Avenue West is a local north-south street. Center Street is an arterial street which defines the northern boundary of the Central Business District. It runs parallel to the old railroad tracks, which were terminated when the Center Mall was developed. North-south streets terminate at Center Street because of the mall in this area. All but two of the north-south streets form T-intersections with Center Street. One of those streets is Fourth Avenue, because it lines up with the west access approach to the mall area.

Center Street is marked for five lanes of traffic, which includes left turn lanes along its length. The most obvious problem with the operation of Center Street is the width of the street. The minimum street width for five lanes of traffic should be 64 feet. Center Street is between 52 and 53 feet wide, which can only accommodate 10.5' lanes. Lane widths of this size are usually used in large metropolitan areas where there is no room for expansion and the street has to carry 50,000 ADT. Safety is not a high priority in that case.

There are also many problems concerning the mall approach. An island in the middle of the approach only hides the exact location of the approach from drivers on Center Street, since it blends into the rest of the roadside landscaping. It also serves the purpose of leading drivers to the wrong side of the approach when entering or leaving. Eight percent of all traffic on this approach enter or exit on the left instead of the right. It was observed that exiting vehicles on the wrong side of the island had to back up while vehicles trying to enter the approach from Center had to wait in traffic lanes for them to clear the way.

At this approach, traffic from the parking lot can enter from almost any direction. When traffic queues in the lot, a jumble of cars at different angles form and block the approach for vehicles entering from Center. All of the potential conflict movements within the intersection are repeated within the throat of the approach, which magnifies potential accidents on the street.

A laydown curb section, on Center Street, carries through the mall approach which creates a dip and limits the entrance and exit speed of vehicles. There are a limited number and length of vehicular gaps on Center Street. The curb section creates capacity and safety problems because vehicles must either wait for longer gaps or chance shorter gaps.

Because of street geometry and building setbacks, sight distance from Fourth Avenue is marginal unless vehicles protrude into the already too narrow traffic lanes on Center Street. Landscaping on the mall side of Center has grown to a height of 30" or more and tends to distract from the vision of oncoming traffic and in some areas, it fully obstructs the line of sight.

There are no stop signs on the exit from the mall lot. Even though stop signs are not normally placed at exits from private property, high traffic volumes on an approach used by the general public should warrant control.

There were 8 angle, 1 sideswipe and 1 rearend accident reported during the four year period that this study encompassed. Road conditions were not a significant factor at this site since only 10% of the accidents occurred on a snowy or icy street surfaces. There were no night time accident. Accidents appear to be clustered around mid-afternoon.

IMPROVEMENTS

The mall entrance condition is the single most identifiable factor contributing to accidents at this intersection. Obvious inadequacies in design of this entrance are magnified by the extreme narrowness of Center street. Considering all factors involved, the most effective short term improvement would require reconstruction of the mall access and a portion of the parking lot. The study improvement sketch indicates one possible method of improvement that addresses most of the problems at this site. The middle traffic island must be removed to eliminate wrong way movements. The curb section must be removed and the approach must be repaved to provide a smoother transition without a dip. Curb radii on the approach must be increased to allow faster exit and entrance maneuvers. Curb sections must extend into the lot for at least three car lengths to channel traffic at right angles to the street and eliminate stacking. There are alternatives to this design which could and should be considered prior to implementation. However, whatever design is selected it should provide the same basic features. Construction of these improvements is highly dependent upon cooperation from the property owners since most of the work would be outside of the street right-of-way.

In addition to the basic physical construction required at this site, other improvements would enhance the operation of this intersection. Left turn words and symbols should be installed on Center Street. This will help drivers identify the location of the approach and side street. A stop sign should be installed at the mall exit. Shrubbery and trees should be trimmed to provide maximum visibility from the stopped approaches.

Long term improvements at this site may depend on the outcome of the transportation plan. If significant system improvements are made which levels traffic growth on Center Street, the most logical improvement would be to modify lane assignments and markings. Center Street could easily handle the current traffic volumes with only three lanes of traffic. If necessary it could also be marked to carry two eastbound thru lanes and one westbound thru lane. If significant traffic increases are projected on Center Street, the only alternative may be widening of the street section to carry five lanes of traffic safely. Significant traffic increases may also require a traffic signal installation at this site.

FOURTH AVE. W & CENTER ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	2800
SOUTH APP	550
EAST APP	8000
WEST APP	7400

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	YES
WARNING	
CONSTRUCT	YES

ESTIMATED COST:

TOTAL	$9,809
MDoT FUND	$2,309
CITY FUND	$7,500

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.4	40%
PDO	3.7	41%

BENEFIT/COST RATIO: 2

	INDEX VALUE	SITE RANK
# ACCIDENTS	67	8
ACCIDENT RATE	19	21
SEVERITY	40	23
VOL/CAPACITY	88	3
SIGHT DIST.	100	9
DRIVER EXPECT	75	8
INFO DEFICIENT	79	6
HAZARD INDEX	57.6	13
B/C RATIO	18	21

PRIORITY	44.53	19

SITE

NUMBER

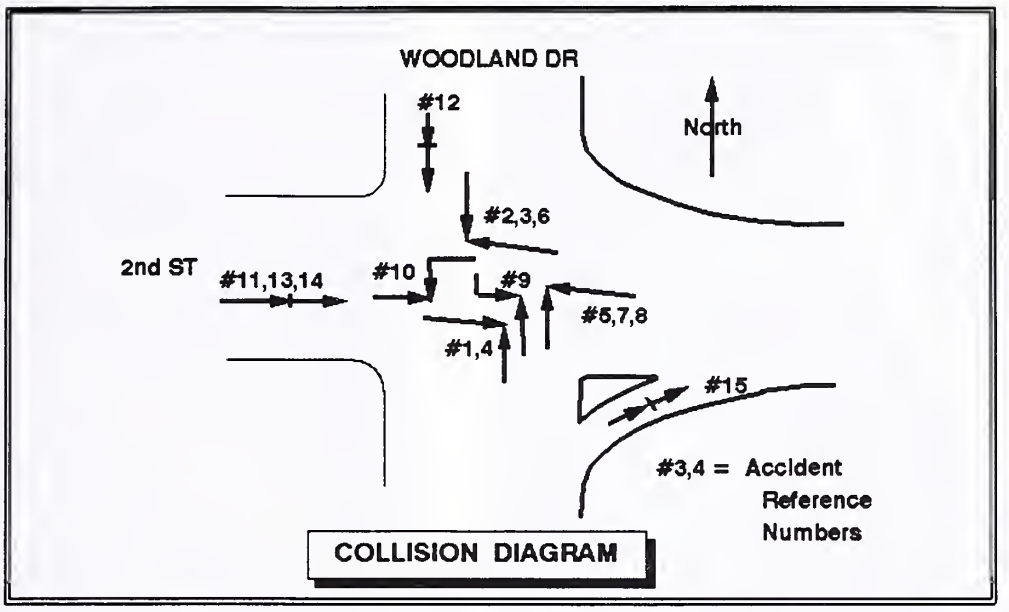
20

WOODLAND DRIVE

and

SECOND STREET

ACCIDENT SUMMARY
WOODLAND DR. & SECOND ST



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	3	24	88	1716	PROP DAM	CLEAR	DRY	DAY
2	ANGLE	5	27	88	1528	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	8	9	88	2255	PROP DAM	CLEAR	DRY	NITE
4	ANGLE	2	13	89	1303	PROP DAM	RAIN	WET	DAY
5	ANGLE	6	28	89	1730	PROP DAM	CLEAR	DRY	DAY
6	ANGLE	2	19	90	1639	INJURY	CLEAR	DRY	DAY
7	ANGLE	12	2	91	1240	INJURY	CLEAR	SNOW	DAY
8	ANGLE	12	19	91	1300	PROP DAM	RAIN	WET	DAY
9	LEFT TURN	8	12	88	1135	PROP DAM	CLEAR	DRY	DAY
10	LEFT TURN	8	6	90	1926	INJURY	CLEAR	DRY	DAY
11	REAREND	10	26	88	1155	INJURY	CLEAR	DRY	DAY
12	REAREND	1	6	89	1610	PROP DAM	CLEAR	ICY	DAY
13	REAREND	2	16	89	1541	PROP DAM	SNOW	SNOW	DAY
14	REAREND	2	26	90	1535	PROP DAM	CLEAR	DRY	DAY
15	REAREND	1	28	91	1644	PROP DAM	CLEAR	ICY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR		
5	1988	#INJ ACC	4
4	1989	#FAT ACC	0
3	1990	#PDO ACC	11
3	1991	PERSON =	4 *
15	TOTAL	NIGHTIME	7%

TYPES	NUMBER	ROAD	
ANGLE	8	DRY	60%
REAR END	5	WET	13%
SIDESWIPE	0	SNOW	13%
LEFT TRN	2	ICE	13%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

WOODLAND DRIVE

Looking South

Looking East

SECOND STREET

Looking West

TRAFFIC OPERATIONS

Woodland Drive is a north-south arterial and a Federal Aid Urban route which runs along the east side of Kalispell proper. Two blocks north of its intersection with Second Street, it turns to the west and becomes Center Street. Second Street is an east-west arterial and also a Federal Aid Urban route which extends between Meridian Road, on the west, to a point just east of Woodland Drive where it splits. Their intersection is in the middle of a residential area. Woodland Park is located in the northeast corner and there are residences in the three remaining corners.

This intersection is quite unique, geometrically. The intersection area is quite wide because the east leg of Second Street enters the intersection at an angle and there is a traffic island in the southeast corner which demarcates and separates a right turn lane. A sharp horizontal curve precedes the westbound approach to the intersection on the east leg. This curve skirts the park property and comes out of a coulee on an 8% grade prior to the intersection. During the winter months, the street is quite slick because it is shaded and stays icy. This is the reason why westbound traffic has been designated a through movement ,while the other three legs of the intersection are controlled by stop signs.

Woodland Drive is much wider than required for two lanes of traffic and it appears to be a major thoroughfare. Unfamiliar drivers approaching the intersection in the southbound direction are often surprised by the unconventional control at this intersection because Woodland appears to be a through street and the stop sign is difficult to see because it is located so far from centerline. Even when the stop sign is acknowledge it is difficult for drivers to determine who else has to stop. Many false starts from the southbound stop occur when westbound vehicles enter the intersection unimpeded. Drivers familiar with the area also have problems on the southbound approach. Since the westbound movement has the highest volume and the highest approach speeds, drivers focus their attention on the east approach and wait for the opportunity to enter the intersection. The majority of southbound vehicles turn left and often times they turn left into the path of a northbound thru vehicle, which was ignored in a moment of haste, when an acceptable westbound gap was encountered.

Eastbound traffic on Second is faced with several dilemmas. The angle of approach is somewhat skewed and the curb angles are almost pointed. From the location where this traffic would normally stop, it is difficult to see traffic coming from the north because of wide boulevards and trees. Vehicles usually pull out beyond the curb to improve the line of sight. Most of eastbound traffic goes straight at the intersection. This movement has conflicts with southbound thru and lefts; northbound thru and lefts; and westbound lefts. Conflict creating the most trepidation is the westbound left because high speed westbound vehicles rise to the intersection and either go straight or left. The eastbound driver is never certain which direction the westbound vehicle will go, since a significant number of drivers don't signal.

Northbound traffic is the most frustrating approach for drivers. Northbound thru and left turning traffic is fairly light, but it is subject to conflicts from all directions. While waiting for a gap in westbound traffic, higher volumes on the southbound and eastbound approaches tend to cut ahead of northbound thru movements. Northbound right turns, which are substantial, are delayed because the right turn lane is stop controlled on a significant downgrade. Line of sight to conflicting eastbound traffic is limited. Gaps in eastbound traffic only occur when there is a steady flow in westbound traffic.

There are a significant number of pedestrians who cross at this intersection and most of them are school age children. There are absolutely no provisions for allowing pedestrians to cross any leg of this intersection. Most of the crossings, noted during the observation periods, resembled an exercise in survival skills rather than a walk in the park.

Accidents at this intersection do not match the potential carnage that one would expect from mere observations of this intersection. There were only 15 accidents at this intersection during the four year study period. Eight angle, two left turn, and five rearend accidents comprised the total. Only 26% were on icy or snow covered streets and there was only one night time accident. Most of them occurred during the afternoon hours.

IMPROVEMENTS

Because of the high traffic volumes at this intersection a traffic signal warrant analysis was completed. It was determined that this intersection meets warrants. A recommendation to install a traffic signal at this intersection may not be greeted with enthusiasm because of the icy conditions for westbound traffic on a steep grade. However, current operations at this intersection have all the potential for tragic results. Avoiding one fatality would pay for many days of traffic delays due to stuck cars. Total reconstruction of this intersection and street approaches would be very expensive and very difficult, if not impossible. Because of these facts, a traffic signal installation is recommended.

The short term improvement sketch indicates the improvements conceived to improve the operation of this intersection using a traffic signal. The signal can be designed to favor westbound traffic flows by using alternative maximum phase extension features in the controller. The maximum extension could be initiated by volume counts provided by an advanced system detection loop. At a predetermined density value, the system would go to an alternative cycle to insure that there would be minimum queue build-up for westbound traffic. The geometry of the westbound approach would provide a left turn lane and a thru lane which would be able to store up to seven cars on top of the grade at the intersection. Proper signal phasing could be timed so that a queue in excess of seven cars would not form very often. In addition, an advance warning flasher for westbound vehicles would indicate an impending stop at the signal so that drivers could adjust speed prior to arriving at the signal.

The most important feature of the signal installation would be the ability to control vehicle paths by separating turning lanes and provide definitive pedestrian protection by using crosswalks and pedestrian signals.

Future improvements at this intersection are not definable at this point. Because of excessive costs that would be associated with reconstruction, future operations at this intersection are highly dependent upon system changes that may be proposed. If Woodland Drive were to be connected directly to Idaho Street (US 2) north of the site, traffic characteristics of this intersection would change significantly. There are many other options that may also be addressed in the transportation plan.

WOODLAND DRIVE & SECOND ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	3600
SOUTH APP	6400
EAST APP	12400
WEST APP	6400

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	
CURB/WALK	YES
MARKING	YES
WARNING	YES
SIGNAL	YES

ESTIMATED COST:

TOTAL	$86,492
MDoT FUND	$7,582
CITY FUND	$78,910

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	2.9	73%
PDO	7.6	69%

BENEFIT/COST RATIO: 1.3

	INDEX VALUE	SITE RANK
# ACCIDENTS	78	3
ACCIDENT RATE	18	22
SEVERITY	47	12
VOL/CAPACITY	100	1
SIGHT DIST.	100	6
DRIVER EXPECT	88	6
INFO DEFICIENT	79	5
HAZARD INDEX	63.4	3
B/C RATIO	5	23

PRIORITY	44.13	20

TRAFFIC SIGNAL WARRANT ANALYSIS
YEAR 1992
WOODLAND DRIVE & SECOND STREET

WARRANT #1 - MINIMUM VEHICULAR VOLUME					
70% WARRANT		REQUIRED		EXISTS	
YES	NO	MAJOR	MINOR	MAJOR	MINOR
8TH HIGHEST HOUR		500	150	610	180
% OF WARRANT MET				122%	120%

WARRANT #2 - INTERRUPTION OF CONTINOUS TRAFFIC					
70% WARRANT		REQUIRED		EXISTS	
YES	NO	MAJOR	MINOR	MAJOR	MINOR
8TH HIGHEST HOUR		750	75	610	180
% OF WARRANT MET				81%	240%

WARRANT #3 - MINIMUM PEDESTRIAN TRAFFIC					
50% WARRANT		REQUIRED		EXISTS	
YES	NO	PEDS	GAPS	PEDS	GAPS
FOUR HOURS		100	60	NA	NA
PEAK HOUR		190	60	NA	NA
% OF WARRANT MET				0%	ERR

WARRANT #4 - SCHOOL CROSSING [STUD	YES	POSSIBLE

WARRANT #5 - PROGRESSIVE MOVEMENT	YES	NO

WARRANT #6 - ACCIDENT EXPERIENCE	YES	NO

WARRANT #7 - SYSTEMS WARRANT	YES	NO

WARRANT #8 - COMBINATION OF WARRANTS				
80 % OF	REQUIRED		EXISTS	
WARRANTS #1 & #2	MAJOR	MINOR	MAJOR	MINOR
WARRANT #1	400	120	610	180
WARRANT #2	600	60	610	180
% OF WARRANT MET			102%	150%

WARRANT #9 - FOUR HOUR VOLUMES				
	MAJOR	MINOR	CURVE NO.	WARRAN
4TH HIGHEST HOUR	705	210	FIGURE	YES
NUMBER OF LANES	1	1	4.7	NO

WARRANT #10 - PEAK HOUR DELAY				
PEAK HOUR:	MINOR LEG		TOTAL ENTERING	
	DELAY	VOLUME	4 LEGS	3 LEGS
REQUIRED VALUES	4	100	800	650
EXISTING VALUES	5	260	1300	

WARRANT #11 - PEAK HOUR VOLUME				
	MAJOR	MINOR	CURVE NO.	WARRAN
PEAK HOUR	900	260	FIGURE	YES
NUMBER OF LANES	1	1	4.5	NO

SUMMARY OF WARRANTS SATISFIED					
WARRANT 1	YES	WARRANT 5		WARRANT 9	YES
WARRANT 2		WARRANT 6		WARRANT 10	YES
WARRANT 3		WARRANT 7		WARRANT 11	YES
WARRANT 4	POSSIBLE	WARRANT 8	YES	TOTAL =	5+

SITE

NUMBER

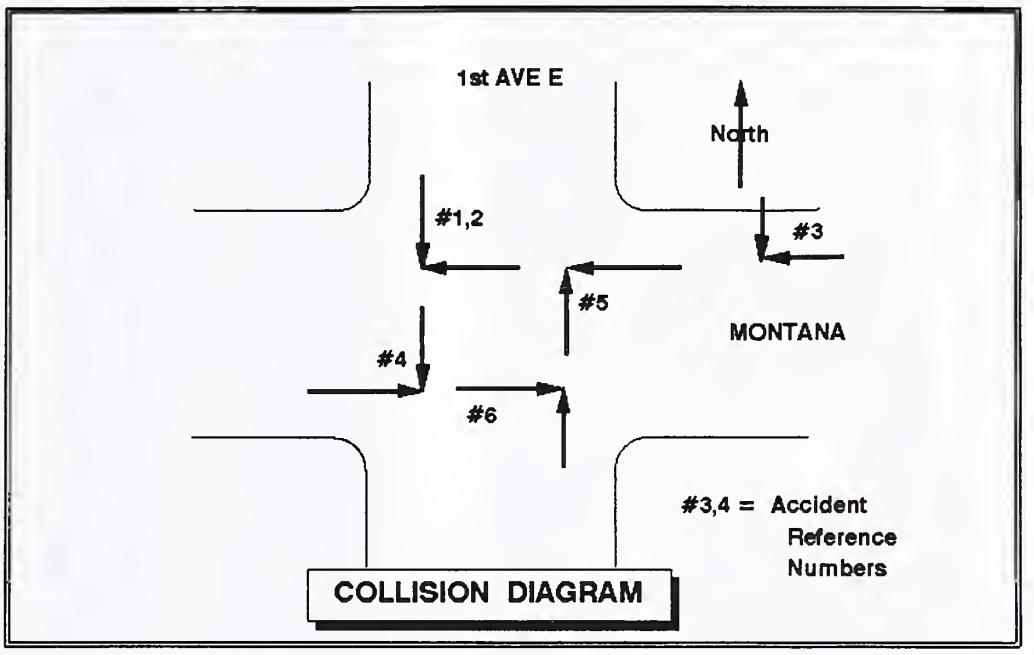
21

FIRST AVENUE EAST

and

MONTANA STREET

ACCIDENT SUMMARY
FIRST AVE. E & MONTANA



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	4	6	88	951	PROP DAM	RAIN	WET	DAY
2	ANGLE	6	24	88	1303	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	12	6	88	1203	PROP DAM	SNOW	SNOW	DAY
4	ANGLE	3	14	89	1142	PROP DAM	CLEAR	DRY	DAY
5	ANGLE	7	13	89	1118	PROP DAM	RAIN	WET	DAY
6	ANGLE	12	17	90	1414	PROP DAM	SNOW	SNOW	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
3	1988	#INJ ACC	0	
2	1989	#FAT ACC	0	
1	1990	#PDO ACC	6	
0	1991	PERSON =	0	*
6	TOTAL	NIGHTIME	0%	

TYPES	NUMBER	ROAD	
ANGLE	6	DRY	33%
REAR END	0	WET	33%
SIDESWIPE	0	SNOW	33%
LEFT TRN	0	ICE	0%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

FIRST AVENUE EAST

Looking South

Looking East

MONTANA STREET

Looking West

TRAFFIC OPERATIONS

First Avenue East is a north-south Federal Aid Urban route which parallels Main Street on the east side. Montana Street is a local east-west street which parallel Idaho Street on the south side. Their intersection is on the northern fringe of the Central Business District within and area where new businesses have developed. There are businesses and parking lots surrounding the intersection. A drive-in bank window, which typically generates a significant amount of traffic, is located in the southeast corner. The intersection is controlled by stop signs on First Avenue East. Double yellow centerlines are marked on First but not on Montana Street. Parking restrictions are marked at the corner with yellow curb paint. The parking restrictions are not adequate for conditions encountered and do not comply with distances specified by state law. Parking demand is moderate to heavy depending on the time of day.

Traffic volumes on First Avenue East are significantly higher than those on Montana Street. Observations indicate that many drivers are not quite sure who is supposed to stop at the intersection. Many drivers on Montana tend to slow and look for a sign, especially if they see a vehicle stopped at the sign on First Avenue. Turning movements are quite significant at this intersection, which reflects the extent of circulation traffic in the area.

Parking lots in the northwest and northeast corners allow parking right to the back of sidewalk in the corners. This condition requires vehicles on the stop street to advance farther into the intersection to see oncoming traffic. Parked vehicles east of the intersection present the most serious sight obstructions since they are allowed to park near the corner radius. A bank sign located in the middle of the southeast corner also creates the same type of sight obstruction as do the parking lots in the north half of the intersection.

The drive-up window at the bank was not particularly active during periods of traffic observations, therefore it was difficult to determine what influence that traffic generator has on the intersection. However, layout of the curb approaches and stacking area for the bank appears to be very poorly designed. The curb cuts for access are much too wide which allows multiple entrys and exists side-by-side. The excess room for multiple vehicle alignments create many conflicts points and causes each vehicle to block

sight distance of the other. This is further complicated on the Montana Street approach, where the alley is not separated from the approach, which creates a 100' curb cut. The available on-site storage for vehicles at the windows appears to be less than adequate. If the bank were to generate an average amount of traffic for similar facilities, entering vehicles would most likely stack onto the street.

There were 6 angle accidents reported during the four year period that this study encompassed. Road conditions were a significant factor at this site since 33% of the accidents occurred on a snowy or icy street surfaces. There were no night time accidents. Most of the accidents occurred around the hour of noon, which would be near peak hour volumes in the downtown area.

IMPROVEMENTS

The most notable traffic control problem at this intersection is the location of stop signs on the major traffic legs of the intersection. Since turning movements at this intersection are not heavy and pedestrian movements are not concentrated in any particular direction, there is no logical reason why the major traffic flow should be required to stop. It has been found that intersections which require the major street to stop have higher accident rates than those which stop the minor leg. The reason is because drivers are creatures of habit. When a certain experience is repeated many times, drivers learn and store that information so that driving reactions become ingrained. Drivers approaching an intersection which requires a stop with never a conflicting vehicle in sight, develops a pattern of disregard for potential conflicts. After a period of time, the habit is ingrained and the subconscious mind completely blocks out the stop condition. Running the stop sign becomes an automatic behavior which reduces the driving task and lets the drivers cognitive abilities react only to perceived hazards. In this case, where buildings and other obstructions are close to the corner, completely inadequate sight distance exists and there is inadequate time for reaction, subconscious control can be dangerous.

Because of this, it is recommended that the existing stop signs be removed

Because of this, it is recommended that the existing stop signs be removed and new, larger stop signs be installed on Montana Street. The new stop condition should be reinforced by marking stop bars. A centerline should also be marked on Montana to delineate vehicle paths and to control improper movements. These will visually inform drivers on Montana that they must stop and First Avenue East traffic is not required to stop. In addition, parking restrictions should be marked with yellow curb paint and signing, as indicated in the improvement sketch. It is also desirable at this location to install stop ahead signs at mid-block when the improvements are implemented to recondition drivers to the change in operation. These signs may may removed after there is evidence that they are no longer required.

Long term improvements at this site would require additional controls on the drive-in approaches to properly control ingress and egress movements. Completion of missing sidewalks in the area would also be important to confine pedestrian crossing at the intersections. If continued development occurs in this area other improvements related to safety and efficiency would be required. It is difficult to determine the exact extent of future improvements that may be implemented without benefit of exact planning data.

FIRST AVE. E & MONTANA ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	2700
SOUTH APP	3300
EAST APP	2000
WEST APP	1700

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	
MARKING	YES
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$950
MDoT FUND	$860
CITY FUND	$90

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.0	0%
PDO	2.4	40%

BENEFIT/COST RATIO: 3

	INDEX VALUE	SITE RANK
# ACCIDENTS	54	21
ACCIDENT RATE	21	19
SEVERITY	34	24
VOL/CAPACITY	54	9
SIGHT DIST.	95	14
DRIVER EXPECT	83	7
INFO DEFICIENT	92	4
HAZARD INDEX	54.3	20
B/C RATIO	23	20

PRIORITY	43.97	21

SITE

NUMBER

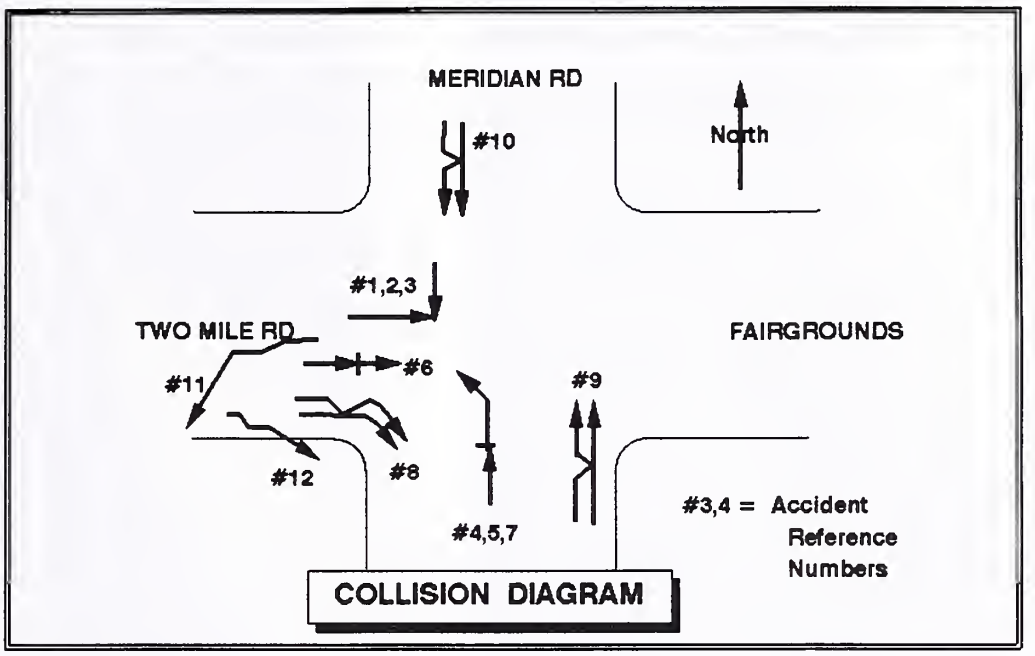
22

MERIDIAN ROAD

and

TWO MILE ROAD

ACCIDENT SUMMARY
MERIDIAN RD & TWO MILE RD



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	5	5	89	1347	INJURY	CLEAR	DRY	DAY
2	ANGLE	12	21	90	1645	PROP DAM	CLEAR	ICY	DAY
3	ANGLE	1	21	91	1618	PROP DAM	SNOW	SNOW	DAY
4	REAREND	12	13	88	1714	PROP DAM	CLEAR	DRY	NITE
5	REAREND	1	28	89	1904	PROP DAM	CLEAR	DRY	DAY
6	REAREND	1	29	90	1225	PROP DAM	SNOW	SNOW	DAY
7	REAREND	10	4	91	806	PROP DAM	CLEAR	DRY	DAY
8	SIDESWIPE	1	7	88	1417	PROP DAM	SNOW	SNOW	DAY
9	SIDESWIPE	6	17	88	1823	PROP DAM	CLEAR	DRY	DAY
10	SIDESWIPE	1	19	91	1741	PROP DAM	CLEAR	SNOW	NITE
11	SINGLE VEH	11	20	89	1845	INJURY	RAIN	WET	NITE
12	SINGLE VEH	12	3	91	1222	PROP DAM	CLEAR	ICY	DAY

ACCIDENT STATISTICS

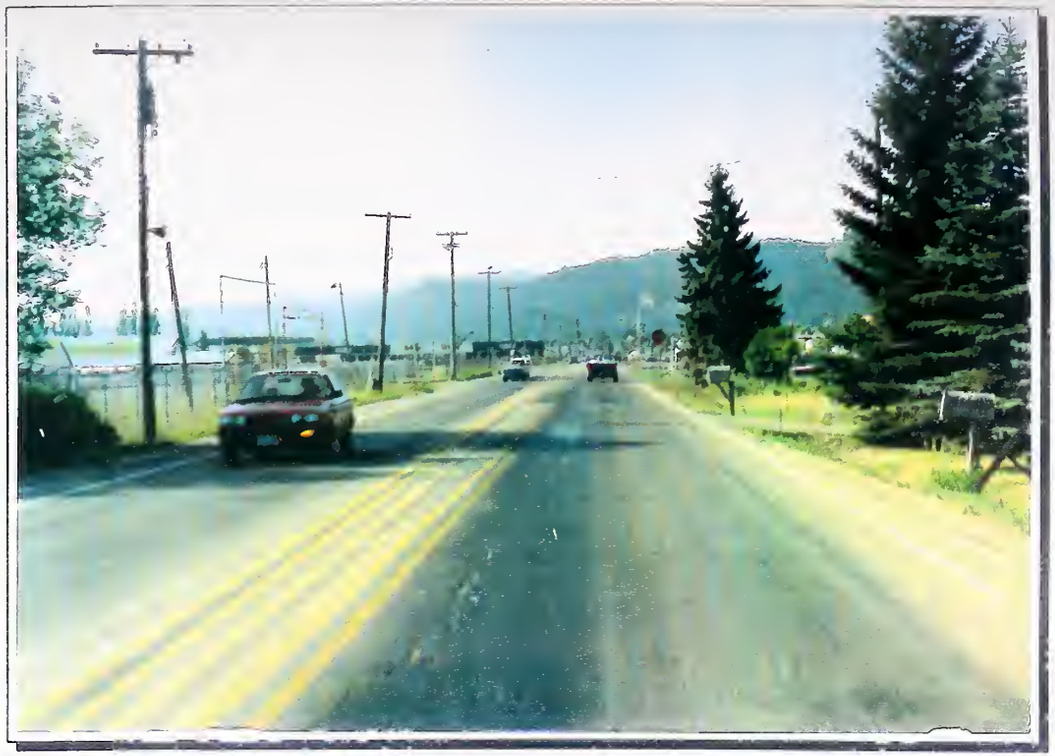
NO. ACC.	YEAR		
3	1988	#INJ ACC	2
3	1989	#FAT ACC	0
2	1990	#PDO ACC	10
4	1991	PERSON =	4 *
12	TOTAL	NIGHTIME	25%

TYPES	NUMBER	ROAD	
ANGLE	3	DRY	42%
REAR END	4	WET	8%
SIDESWIPE	3	SNOW	33%
LEFT TRN	0	ICE	17%
OTHER	2	OTHER	0%

*** No. of Persons Injured**

Looking North

MERIDIAN ROAD



Looking South

Looking East

TWO MILE ROAD

Looking West

TRAFFIC OPERATIONS

Meridian Road is a north-south arterial on the west end of Kalispell. It intersects Idaho Street (US 2), which is a major east-west arterial through the city. Two Mile Road is an east-west arterial street that serves rural subdivisions west of Kalispell. Its intersection with Meridian Road is the eastern terminus of Two Mile Road. This intersection is in the middle of a rural type area. The county fairgrounds are located on the east side of Meridian Road and a main entrance to the fairgrounds is located at this intersection and functions as the east leg of the intersection.

The intersecting roadways are both built to rural highway standards. There are no curb sections. There are deep drainage ditches on either side of these roads. The pavement is currently marked for three lanes on Meridian, south of the intersection. These markings are somewhat unconventional because there are two sets of double solid lines. The intersection is controlled by four-way stop signs. Stop ahead signs are located on the Meridian approaches. The signs are minimum size, but plainly visible. The stop sign on the eastbound direction tends to blend in with buildings and equipment located in the fairgrounds' background. There are three stop signs for the westbound approach coming out of the fairgrounds. Of particular interest is the fact that one of the stop signs is located well within the paved approach and protected by steel posts. This arrangement is not in the best interests of safety.

This intersection carries very high traffic volumes, especially during peak hour periods. There is a heavy northbound left turn movement and a heavy eastbound right turn movement. Pedestrian usage at this intersection is light or nonexistant. Operationally, delay is significant at this intersection. Long queues build up on all legs of the intersection, except the fairgrounds approach, during peak hours. This intersection used to be a two-way stop on Two Mile Road. Mr. Hossack indicated that the accident problem was so bad that they changed it to a four-way stop. It is now apparent that delay is very costly and different types of accidents are occurring.

A large pine tree in the northwest corner of the intersection completely blocks sight distance to the north from the stopped position on the westbound leg. If

this tree would have been removed years ago, the intersection would probably not have an extensive history of angle accidents prior to installation of the four-way stop.

There were 12 accidents at this location during the study reporting period. These accidents included 3 angle, 2 single vehicle, 4 rearend and 3 sideswipe accidents. Fifty percent of the accidents occurred on snowy or icy streets and 25% occurred during night time hours. The majority of accidents happened during the late afternoon, peak traffic periods.

IMPROVEMENTS

Because of the high traffic volumes, a traffic signal warrant analysis was completed at this location. A summary analysis can be found at the end of this section. The analysis indicated that this intersection meets warrants for signalization. Even though the major warrants are not yet met, historic traffic growth would indicate that they would be met by the time the signal is constructed. Also, construction of the new main post office just south of this intersection and other new developments will probably accelerate the time when all of the signal warrants are met. Therefore, the recommended improvements at this intersection pertain to installation of a traffic signal.

Widening of the eastbound approach is considered necessary to better align the intersection in an east-west direction for the intersection to work properly. In addition, widening will allow use of an exclusive right lane, which will improve the overall efficiency of the intersection. Newly aligned lanes with new pavement markings on the fairgrounds approach will provide better operations when there are special events and this approach is heavily used.

Even though the signal will control and protect traffic movements, it would still be considered necessary to trim the large pine tree in the northwest corner. Right turning vehicles must be able to turn on red safely in order to achieve a higher level of efficiency.

Because of the complexity of this recommendation, it will be necessary to plan and design these improvements prior to implementation. It is not advised that these improvements be pieced together. A qualified Traffic Engineer must be used to develop formal plans and specifications prior to construction. It is also recommended that a design study precede final design, which would identify planned developments in the area and predict necessary traffic facilities needed within the immediate area of this intersection, so that they can be incorporated into the design.

Future improvements at this site are totally dependent upon the outcome of the transportation plan. This intersection is part of corridor problem which will continue to worsen as Kalispell grows. For further discussion, see the corridor section in the main body of this report.

MERIDIAN RD. & TWO MILE RD.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	11200
SOUTH APP	12600
EAST APP	600
WEST APP	4100

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	
YIELD	
STOP	
CONSTRUCT	YES
MARKING	YES
WARNING	YES
SIGNALS	YES

ESTIMATED COST:

TOTAL	$80,986
MDoT FUND	$825
CITY FUND	$80,161

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	1.4	70%
PDO	4.8	48%

BENEFIT/COST RATIO: 1.2

	INDEX VALUE	SITE RANK
# ACCIDENTS	72	5
ACCIDENT RATE	15	23
SEVERITY	50	8
VOL/CAPACITY	100	2
SIGHT DIST.	100	5
DRIVER EXPECT	92	5
INFO DEFICIENT	79	7
HAZARD INDEX	62.9	4
B/C RATIO	4	24

PRIORITY	43.46	22

TRAFFIC SIGNAL WARRANT ANALYSIS
YEAR 1992
MERIDIAN ROAD & TWO MILE ROAD

WARRANT #1 - MINIMUM VEHICULAR VOLUME					
70% WARRANT		REQUIRED		EXISTS	
YES	NO	MAJOR	MINOR	MAJOR	MINOR
8TH HIGHEST HOUR		600	150	740	130
% OF WARRANT MET				123%	87%

* Possible to reduce volumes due to speed.

WARRANT #2 - INTERRUPTION OF CONTINOUS TRAFFIC					
70% WARRANT		REQUIRED		EXISTS	
YES	NO	MAJOR	MINOR	MAJOR	MINOR
8TH HIGHEST HOUR		900	75	740	130
% OF WARRANT MET				82%	173%

WARRANT #3 - MINIMUM PEDESTRIAN TRAFFIC					
50% WARRANT		REQUIRED		EXISTS	
YES	NO	PEDS	GAPS	PEDS	GAPS
FOUR HOURS		100	60	NA	NA
PEAK HOUR		190	60	NA	NA
% OF WARRANT MET				0%	ERR

WARRANT #4 - SCHOOL CROSSING [STUD	YES	NO

WARRANT #5 - PROGRESSIVE MOVEMENT	YES	NO

WARRANT #6 - ACCIDENT EXPERIENCE	YES	NO

WARRANT #7 - SYSTEMS WARRANT	YES	NO

WARRANT #8 - COMBINATION OF WARRANTS				
80 % OF	REQUIRED		EXISTS	
WARRANTS #1 & #2	MAJOR	MINOR	MAJOR	MINOR
WARRANT #1	480	120	740	130
WARRANT #2	720	60	740	130
% OF WARRANT MET			103%	108%

WARRANT #9 - FOUR HOUR VOLUMES				
	MAJOR	MINOR	CURVE NO.	WARRAN
4TH HIGHEST HOUR	830	145	FIGURE	YES
NUMBER OF LANES	2	1	4.7	NO

WARRANT #10 - PEAK HOUR DELAY				
PEAK HOUR:	MINOR LEG		TOTAL ENTERING	
	DELAY	VOLUME	4 LEGS	3 LEGS
REQUIRED VALUES	4	100	800	650
EXISTING VALUES	7	155	1050	

WARRANT #11 - PEAK HOUR VOLUME				
	MAJOR	MINOR	CURVE NO.	WARRAN
PEAK HOUR	920	155	FIGURE	YES
NUMBER OF LANES	2	1	4.5	NO

SUMMARY OF WARRANTS SATISFIED					
WARRANT 1		WARRANT 5		WARRANT 9	
WARRANT 2		WARRANT 6		WARRANT 10	YES
WARRANT 3		WARRANT 7		WARRANT 11	
WARRANT 4		WARRANT 8	YES	TOTAL =	2

SITE

NUMBER

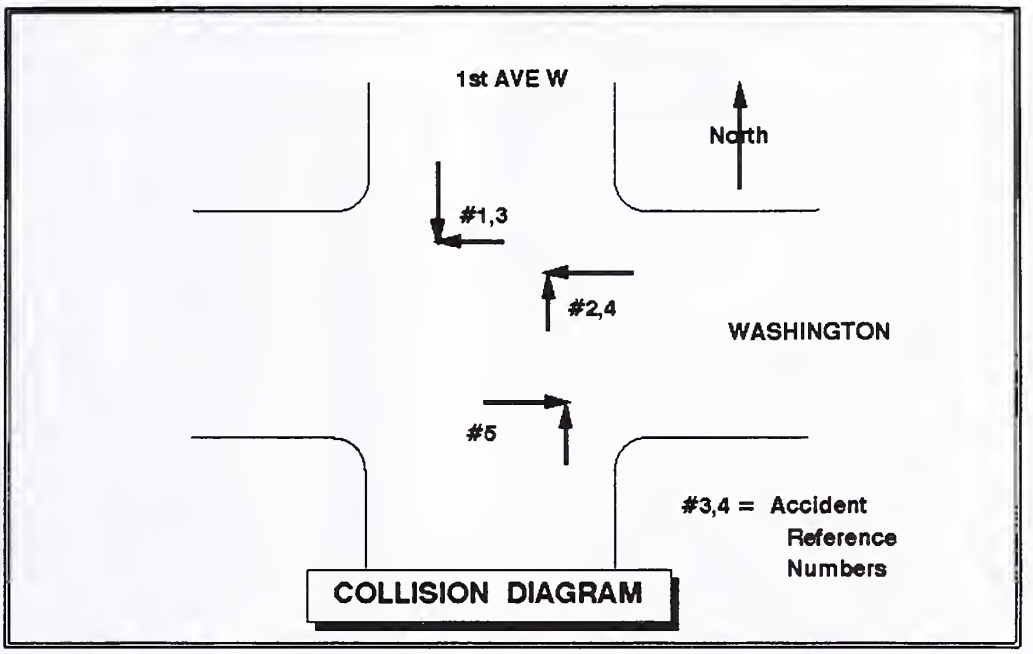
23

FIRST AVENUE WEST

and

WASHINGTON STREET

ACCIDENT SUMMARY
FIRST AVE. W & WASHINGTON



ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	1	26	88	1514	INJURY	CLEAR	ICY	DAY
2	ANGLE	1	23	89	1616	PROP DAM	CLEAR	DRY	DAY
3	ANGLE	9	5	89	920	PROP DAM	CLEAR	DRY	DAY
4	ANGLE	11	22	89	1354	PROP DAM	CLEAR	DRY	DAY
5	ANGLE	4	19	90	1529	PROP DAM	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
1	1988	#INJ ACC	1	
3	1989	#FAT ACC	0	
1	1990	#PDO ACC	4	
0	1991	PERSON =	1	*
5	TOTAL	NIGHTIME	0%	

TYPES	NUMBER	ROAD	
ANGLE	5	DRY	83%
REAR END	0	WET	0%
SIDESWIPE	0	SNOW	0%
LEFT TRN	0	ICE	17%
OTHER	0	OTHER	0%

*** No. of Persons Injured**

Looking North

FIRST AVENUE WEST

Looking South

Looking East

WASHINGTON STREET

Looking West

TRAFFIC OPERATIONS

Washington Street is a local east-west street which is one block south of and parallel to Idaho Street (US 2). Washington Street carries some spill-over traffic from both Idaho Street and Main Street because of congestion at their intersection, northeast of this study site. First Avenue West is a local street. Surrounding land use at this site consists of residential dwellings in three corners and a parking lot for a large office building in the southeast corner.

The intersection is currently controlled by stop signs on First Avenue West. No other traffic control devices exist at this location. There are parking restrictions marked near the corners, but they are inadequate for the conditions and do not comply with distances specified by state law. Parking demand is moderate to heavy. The northbound stop sign is almost totally obscured by tree branches. Curb and gutter exists in all quadrants and sidewalks do not exist in some areas and they do not extend to the street on the south side of the intersection. Picnic tables in the southeast corner of the intersection in the boulevard area are the gathering spot for local office workers during numerous times of the day. Their presence, in that location, can sometimes be rather distracting to drivers, because of the activity created.

There were 5 angle accidents at this location during the four year reporting period. None of these accidents occurred in 1991. These accidents encompassed most directions of travel. Eighty three percent of the accidents occurred on clear dry roads. None of the accidents occurred during night time hours. Almost all of the accidents occurred between the hours of 1 and 4 PM.

Analysis of accident reports indicated that this intersection had been experiencing one or more angle accidents per year until 1991. Additional efforts were made to search for missing accident reports, which was futile. Further analysis indicated that none of the reports indicated stop signs were present at this intersection, which means that the stop signs were installed sometime after April 19, 1990. According to these records, the stop sign effectively eliminated accidents at this high accident rate location.

IMPROVEMENTS

Even though the new stop signs have produced a 100% reduction in accidents based on one year's data, statistics would indicate that 1991 was an anomaly. Over the long run, the most optimistic reductions would be approximately 70% and it is anticipated that one accident per year could still be expected at this intersection. In order to further improve the probability of limiting incidents to chance accidents at this location, mobile sight obstructions must be totally eliminated. The short terms improvement sketch indicates the necessary signing and markings necessary to control parking near the intersection. The parking setbacks were computed using a dynamic vehicle model which considers gap requirements to cross Washington and 85th% vehicle speeds. In addition, trimming of trees are absolutely necessary to uncover the stop sign on the northbound approach.

As with the adjacent intersection with First Avenue, pavement markings at this intersection are considered necessary to provide positive guidance and to add a measure of safety. A double yellow centerline should be painted on Washington Street.

Long term improvements will be highly dependent upon the future status of area street operations.

FIRST AVE. W & WASHINGTON ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	700
SOUTH APP	1000
EAST APP	1000
WEST APP	1000

EXISTING CONTROL:

NONE	
YIELD	
STOP	YES
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CONSTRUCT	
MARKING	
WARNING	
SIGNALS	

ESTIMATED COST:

TOTAL	$825
MDoT FUND	$725
CITY FUND	$100

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.2	15%
PDO	0.6	15%

BENEFIT/COST RATIO: 3

	INDEX VALUE	SITE RANK
# ACCIDENTS	50	24
ACCIDENT RATE	39	13
SEVERITY	44	17
VOL/CAPACITY	22	15
SIGHT DIST.	100	2
DRIVER EXPECT	54	21
INFO DEFICIENT	54	23
HAZARD INDEX	48.7	23
B/C RATIO	25	19

PRIORITY	40.88	23

SITE

NUMBER

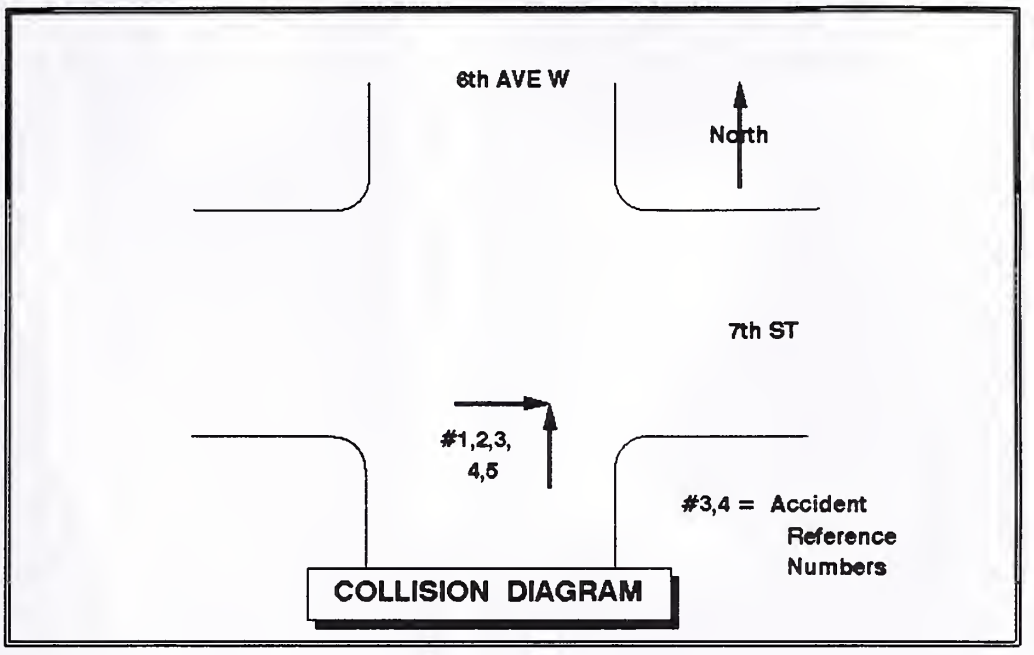
24

SIXTH AVENUE WEST

and

SEVENTH STREET

ACCIDENT SUMMARY
SIXTH AVE. W & SEVENTH ST



ACCIDENT KEY

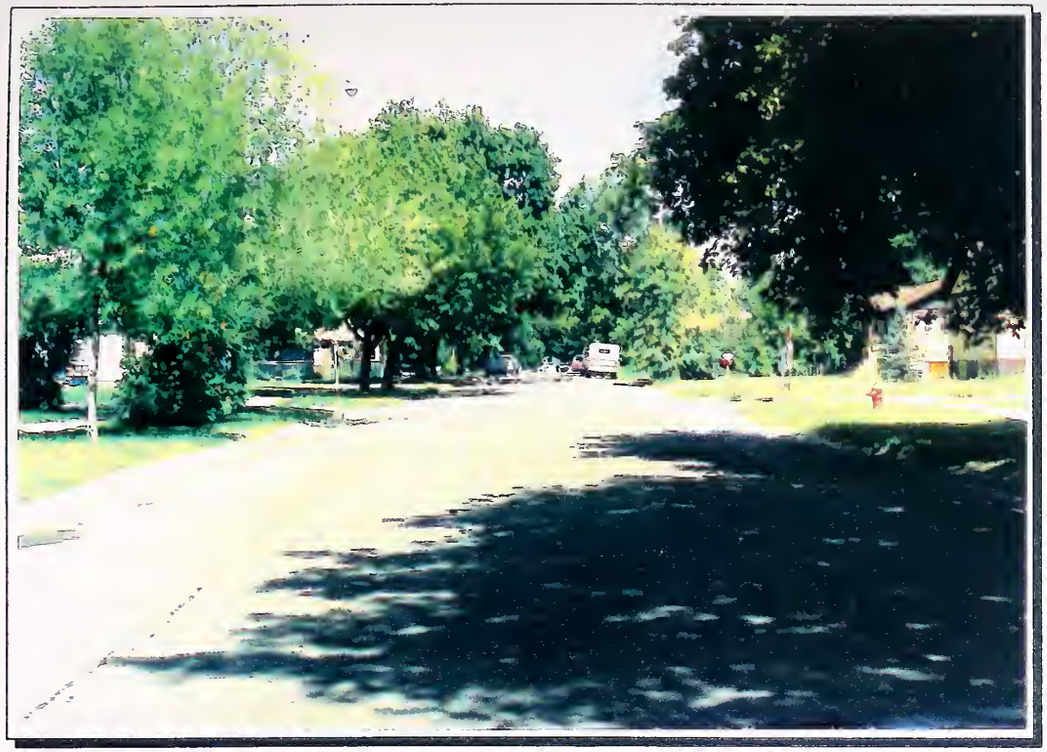
ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	1	2	89	1717	PROP DAM	CLEAR	ICY	NITE
2	ANGLE	4	26	89	754	PROP DAM	CLEAR	WET	DAY
3	ANGLE	11	28	89	825	PROP DAM	CLEAR	ICY	DAY
4	ANGLE	2	7	90	908	PROP DAM	CLEAR	ICY	DAY
5	ANGLE	4	14	90	906	PROP DAM	CLEAR	WET	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
0	1988	#INJ ACC	0	
3	1989	#FAT ACC	0	
2	1990	#PDO ACC	5	
0	1991	PERSON =	0	*
5	TOTAL	NIGHTIME	20%	

TYPES	NUMBER	ROAD	
ANGLE	5	DRY	20%
REAR END	0	WET	40%
SIDESWIPE	0	SNOW	0%
LEFT TRN	0	ICE	40%
OTHER	0	OTHER	0%

*** No. of Persons Injured**



Looking North

SIXTH AVENUE WEST

Looking South

Looking East

SEVENTH STREET

Looking West

TRAFFIC OPERATIONS

Seventh Street is a local east-west street and Sixth Avenue West is a local north-south street. Their intersection is in the middle of a residential area just west of Kalispell High School. This intersection is heavily influenced by high school traffic and parking. Both streets have tree lined boulevards with large deciduous trees located mostly in the corners of the intersection. Parking is allowed on both sides of the street and demand for parking appears to be extremely high when school is in session. Seventh street does not have curb & gutter west of the intersection and Sixth is missing curb on alternating sides of the street. There are no sidewalks along Seventh or on the east side of Sixth north of the intersection. Traffic volumes on Sixth Avenue are very low, while Seventh Street has about double the volume at 900 vehicles per day.

Sight distance is the most obscured in the southwest corner where bushes completely cut off the available sight distance. Trees with low hanging branches also provide a significant loss of sight distance in the northwest corner. Parked vehicles, during schools hours, makes the intersection seem congested and cars parked near the corner interfere with proper sight distance. Street surfaces are extremely rough.

It was observed that when school begins in the morning and ends in the afternoon, this area is a flurry of activity. Students must walk in the street and they park there cars throughout the immediate area.

There were 5 angle accidents reported during the four year period that this study encompassed. All of the accidents involved the northbound and eastbound movements which would indicate that the bushes in the corner provide a site obstruction that is not obvious to drivers. Road conditions were significant at this site since 40% of the accidents occurred on snowy or icy street surfaces. There was one night time accident. Most of the accidents occurred between the hours of 8 AM and 9 AM. No accidents occurred during the summertime.

IMPROVEMENTS

The apparent conditions contributing to accidents at this location are sight obstructions caused by bushes in the southwest corner and by parked vehicles. Since the sight restrictions which exist at this intersection are not permanent, it is possible to remove the sight obstructions. The site improvement sketch indicates the installation of yield signs. This recommendation is a precautionary measure. If yield signs are not a common control device used in Kalispell, it may be better to not include them at all.

Parking restriction signs and curb markings, where possible, should be implemented to allow adequate sight distance from the stopped approach. The improvement sketch indicates required parking setbacks as determined by dynamic vehicle modeling of conflicting approach vehicles.

Long term improvements at this site would include construction of curb/gutter and sidewalks where they do not currently exist. This work would most likely take the form of a special improvement district or some other funding source related to pedestrian safety.

SIXTH AVE. W & SEVENTH ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	450
SOUTH APP	350
EAST APP	900
WEST APP	850

EXISTING CONTROL:

NONE	YES
YIELD	
STOP	
SIGNAL	

RECOMMENDED CONTROL:

PARKING	YES
YIELD	YES
STOP	
CURB/WALK	
MARKING	
WARNING	
REGULATORY	

ESTIMATED COST:

TOTAL	$1,695
MDoT FUND	$1,445
CITY FUND	$250

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.0	0%
PDO	2.5	50%

BENEFIT/COST RATIO: 1.8

	INDEX VALUE	SITE RANK
# ACCIDENTS	50	25
ACCIDENT RATE	52	10
SEVERITY	34	25
VOL/CAPACITY	12	22
SIGHT DIST.	35	24
DRIVER EXPECT	58	15
INFO DEFICIENT	67	13
HAZARD INDEX	46.1	25
B/C RATIO	12	22

PRIORITY	34.85	24

SITE

NUMBER

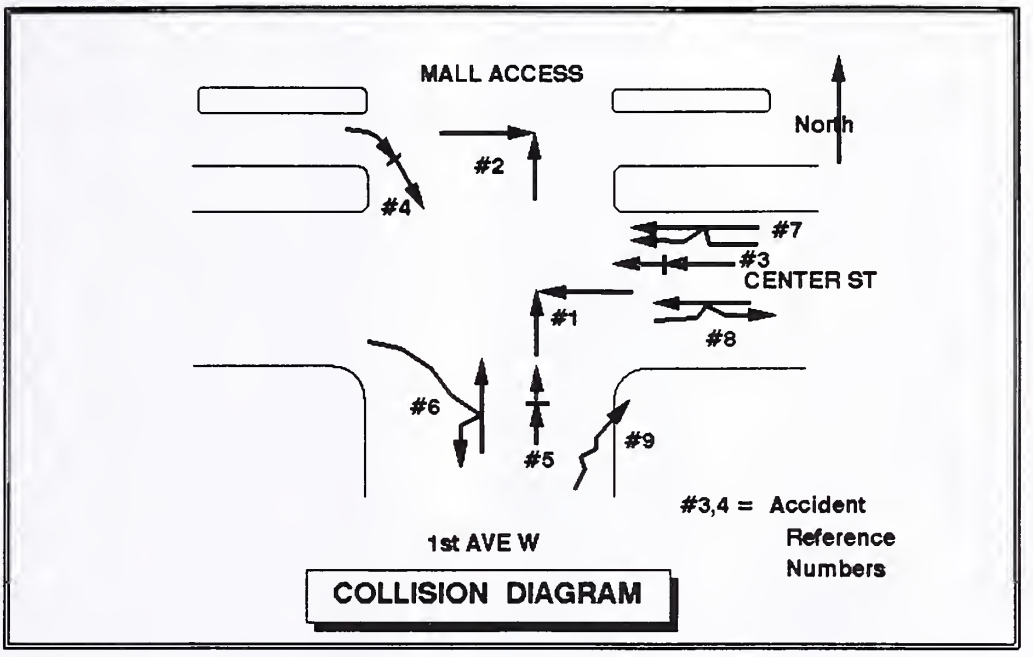
25

FIRST AVENUE WEST

and

CENTER STREET

ACCIDENT SUMMARY
FIRST AVE. W & CENTER



COLLISION DIAGRAM

ACCIDENT KEY

ACC NO.	ACCIDENT TYPE	MO.	DAY	YEAR	TIME	SEVERITY	WEATHER	ROAD	LIGHT
1	ANGLE	5	8	89	1158	PROP DAM	CLEAR	DRY	DAY
2	ANGLE	12	31	91	1158	PROP DAM	CLEAR	DRY	DAY
3	REAREND	2	23	88	1657	PROP DAM	CLEAR	DRY	DAY
4	REAREND	5	17	88	1711	INJURY	CLEAR	DRY	DAY
5	REAREND	5	25	89	1741	PROP DAM	CLEAR	DRY	DAY
6	SIDESWIPE	3	4	89	1823	PROP DAM	CLEAR	ICY	DAY
7	SIDESWIPE	8	16	91	936	PROP DAM	CLEAR	DRY	DAY
8	SIDESWIPE	10	17	91	1308	PROP DAM	CLEAR	DRY	DAY
9	SINGLE VEH	9	14	90	835	INJURY	CLEAR	DRY	DAY

ACCIDENT STATISTICS

NO. ACC.	YEAR			
2	1988	#INJ ACC	2	
3	1989	#FAT ACC	0	
1	1990	#PDO ACC	7	
3	1991	PERSON =	3	*
9	TOTAL	NIGHTIME	0%	

TYPES	NUMBER	ROAD	
ANGLE	2	DRY	89%
REAR END	3	WET	0%
SIDESWIPE	3	SNOW	0%
LEFT TRN	0	ICE	11%
OTHER	1	OTHER	0%

*** No. of Persons Injured**

Looking North

FIRST AVNEUE WEST

Looking South

Looking East

CENTER STREET

Looking West

TRAFFIC OPERATIONS

First Avenue West is a principal street within the Central Business District and a Federal Aid Urban north-south route through the downtown area of Kalispell. Center Street is an arterial street which defines the northern boundary of the Central Business District. It runs parallel to the old railroad tracks which were terminated when the Center Mall was developed. North-south streets terminate at Center Street because of the mall, in this area. All but two of the north-south streets form T-intersections with Center Street. One of those streets is First Avenue, because it lines up with the the major access approach to the mall area.

Center Street is marked for five lanes of traffic, which includes left turn lanes along its length. The most obvious problem with the operation of Center Street is the width of the street. The minimum street width for five lanes of traffic should be 64 feet. Center Street is between 52 and 53 feet wide, which can only accommodate 10.5' lanes. Lane widths of this size are usually used in large metropolitan areas where there is no room for expansion and the street has to carry 50,000 ADT. Safety is not a high priority in that case.

There are also many problems concerning the mall approach. An island in the middle of the approach only hides the exact location of the approach from drivers on Center Street, since it blends into the rest of the roadside landscaping. It also serves the purpose of leading drivers to the wrong side of the approach when entering or leaving. Two percent of all traffic on this approach exits on the left instead of the right. It was observed that exiting vehicles on the wrong side of the island had to back up while vehicles trying to enter the approach from Center had to wait in traffic lanes for them to clear the way. The island also prevents the mall exit lanes from lining up with the opposite lanes on First Avenue west. The island, combined with tight curb radii and narrow lanes on Center Street, also makes it difficult for larger vehicles to turn right from the westbound lane. During a one hour observation period, a tour bus and a recreational vehicle, in separate incidence, became wedged between the curb and the island and had to back out into Center Street to try a different angle of approach.

Within the parking lot, at the access approach, serious conflicts are insured by the circulation design of the lot. The mall is built parallel to Center Street, extending from First Avenue to Fourth Avenue. The distance of the mall to Center street is such that the parking lot has long circulation rows parallel to Center, two rows of which exit at the First Avenue approach. With such long rows, a significant number of cars are required to access this approach. This row of vehicles enters the approach parallel to the signal approximately 30 feet from the curb on Center. Traffic from other rows of parking approach the intersection perpendicular to Center in direct conflict with the parallel row. Since the row parallel to Center continues thru the throat of the access approach and vehicles are unrestricted from crossing the access road to continue down the row, all sorts of conflicts are created. There are nine potentially serious conflicts just within the throat of the mall access. Even if these conflict points don't result in accidents, they destroy any operating efficiency that this intersection could have.

A laydown curb section, on Center Street, carries through the mall approach which creates a dip that limits the entrance and exit speed of vehicles. It is estimated that the headway times for vehicles entering and exiting at the mall access are at least 20% greater than those found at an average intersection. This not only reduces the approach efficiency, but it affects the entire intersection efficiency and safety.

Signal operations at this intersection are inefficient because the mall and First Avenue do not have concurrent or overlapped phases and the lane designations do not make the best use of the pavement width commensurate with turning movement demand. When combined with higher headway times on the mall access, the actual level of service at this intersection is much less than it should be, with the level of traffic volumes entering.

The existing signal heads are a unique combination of sizes, which would lead one to assume that the signal was constructed with spare parts. Mast arm heads are mostly 8" lenses with a 12"x8"x8" indication thrown in sporadically.

This intersection only provides for pedestrian crossings on the east side and on the south side. However, there are no marked x-walks, stop bars or pedestrian regulatory signs. Pedestrians were observed crossing on all legs of the intersection, and in some cases, not very safely.

The only regulatory signs existing at the site are parking signs and lane designation signs. The mast arm lane designation signs are very unconventional. Lane designation R3-8 type signs are mounted on the mast arms, which is contrary to MUTCD, because those signs are intended for ground mounting. The lane signs mounted on the mast arm for the mall exit is a starburst arrow with the legend "On Green". Unless it means, "explode and scatter on green", its intended function is not known.

There were nine accidents at this site during the four year period, which is surprising low considering the number of opportunities presented. There were 2 angle, 3 rearend, 3 sideswipe and 1 single vehicle accidents included in the total. Two of the nine were within the throat of the mall access approach. There is a possibility that more accidents occurred in this area, since accident reports on private property were discarded early in the study's accident screening process. Only 11% of the accidents occurred on icy or snowy streets. All or the accidents occurred during peak AM and PM traffic hours.

IMPROVEMENTS

The mall entrance condition is the single most identifiable factor contributing to accidents at this intersection since its operation also effects the entire intersection. Obvious inadequacies in design of this entrance are magnified by the extreme narrowness of Center street. Considering all factors involved, the most effective short term improvement would require reconstruction of the mall access and a portion of the parking lot. The study improvement sketch indicates one possible method of improvement that addresses most of the problems at this site. The middle traffic island must be removed to eliminate wrong way movements and provide a better alignment with First Avenue on the south side. The curb section must be removed and the approach must be repaved to provide a smoother transition without a dip. Curb radii on the

approach must be increased to allow faster exit and entrance maneuvers. Curb sections must extend into the lot for at least three car lengths to channel traffic at right angles to the street and eliminate cross traffic movements which conflict with vehicles entering the mall from the signalized intersection.

New lane designations can be marked once the physical reconstruction is assured. A single left turn lane from the mall access, should be lined directly with an opposing left from First Avenue. This will require addition of an exclusive left from First Avenue and eliminating one southbound lane, which is not currently needed for capacity. Redesignation of lane control will allow modifications to the signal operation, which can be a full 8 phase, quad operation or any other combination which allows concurrent vehicle movements. Signal modifications would require one new pole, new wiring, new signal indications, new pedestrian indications, and new loop detectors. Reprogramming the phases would also be required.

All of the mast arm lane control signs can be replaced with more meaningful designations. New, larger street name signs, mounted on mast arms will also provide a better degree of positive guidance for this site, where a significant number of drivers are from out of town.

Most importantly, marking of crosswalk and pedestrian regulatory signs will improve safety of pedestrian crossings and reduce liability for any mishaps occurring outside of the designated crosswalks.

There are alternatives to these design concepts which could and should be considered prior to implementation. However, whatever design is selected it should provide the same basic features. Construction of these improvements is highly dependent upon cooperation from the property owners since most of the work would be outside of the street right-of-way.

This is the only one of the twenty five study sites that does not have a benefit/cost ratio in excess of one. This doesn't mean that the proposed improvements are not worth the investment. It must be remember that the B/C ratio is only calculated for safety related improvements. If efficiency

savings for just fuel consumption were added in, the annual benefit would be triple the projected benefit for accident reductions. Also, the mall owners would realize a benefit from this project by improving the safety and efficiency of access to their facilities. If they can't readily acknowledge a benefit at this point in time, future traffic growth on the street system and gridlock at their entrance would surely convince them.

Long term improvements at this site are similar to the west mall access site and may depend on the outcome of the transportation plan. If significant system improvements are made which levels traffic growth on Center Street, the most logical improvement would be to modify lane assignments and markings. Center Street could easily handle the current traffic volumes with only three lanes of traffic. If necessary it could also be marked to carry two eastbound thru lanes and one westbound thru lane. If significant traffic increases are projected on Center Street, the only alternative may be widening of the street section to carry five lanes of traffic safely.

FIRST AVE. W & CENTER ST.

SITE DATA SUMMARY

TRAFFIC VOLUMES:

	ADT
NORTH APP	3100
SOUTH APP	7500
EAST APP	8900
WEST APP	8200

EXISTING CONTROL:

NONE	
YIELD	
STOP	
SIGNAL	YES

RECOMMENDED CONTROL:

PARKING	YES
YIELD	
STOP	YES
CURB/WALK	YES
MARKING	YES
CONSTRUCT	YES
SIGNAL MOD	YES

ESTIMATED COST:

TOTAL	$44,542
MDoT FUND	$6,787
CITY FUND	$37,755

% ACCIDENT REDUCTION:

	NUMBER	PERCENT
INJ/FTL	0.4	20%
PDO	3.8	54%

BENEFIT/COST RATIO: 0.7

	INDEX VALUE	SITE RANK
# ACCIDENTS	64	11
ACCIDENT RATE	12	25
SEVERITY	50	9
VOL/CAPACITY	62	7
SIGHT DIST.	37	23
DRIVER EXPECT	71	10
INFO DEFICIENT	63	15
HAZARD INDEX	48.2	24
B/C RATIO	-8	25

PRIORITY	29.65	25